ELECTRICAL REVIEW

AUGUST 1957 PRICE 1s 6d

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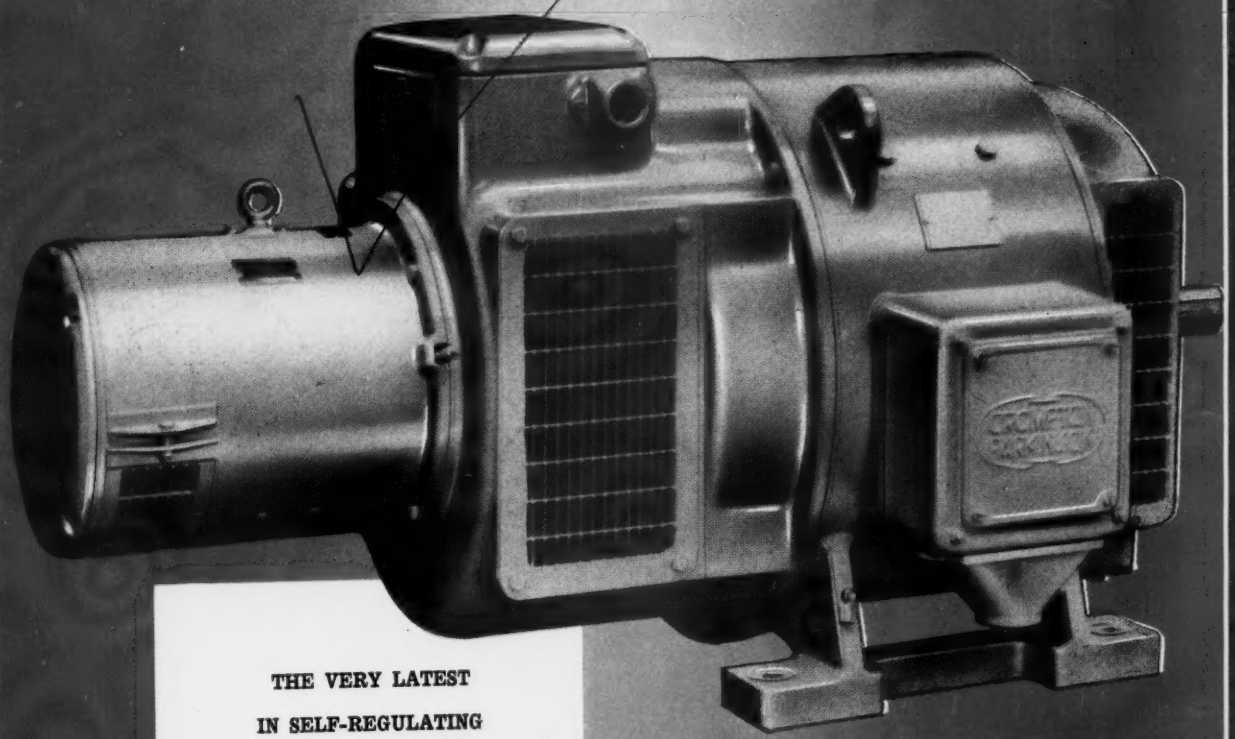

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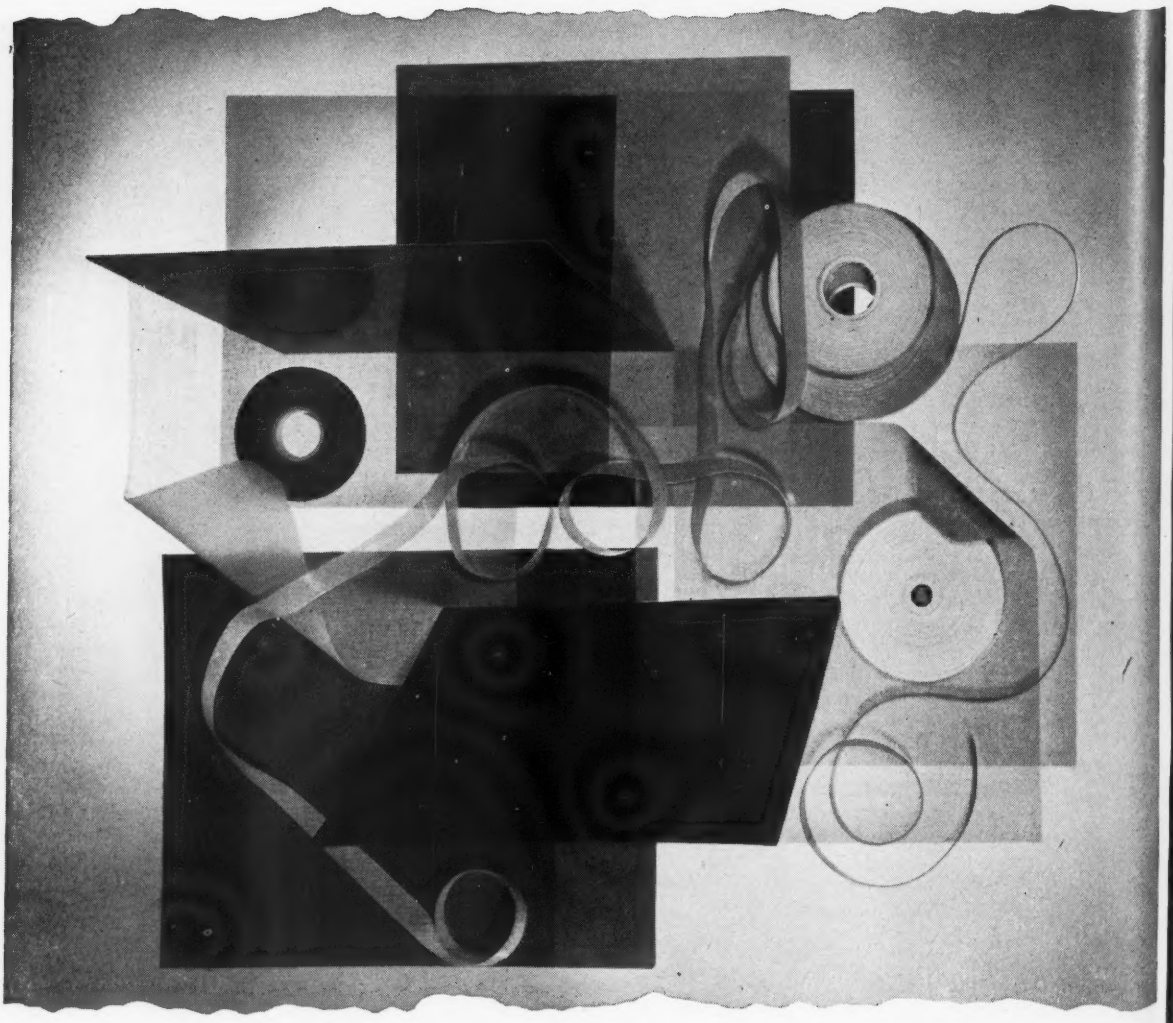

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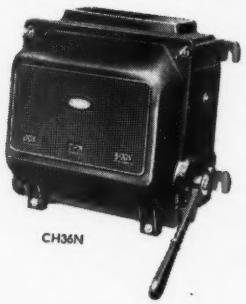
DENNIS TYPE 'H'

STANDARD PATTERNS

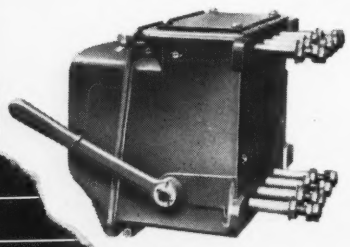
FRONT CONNECTED PATTERN SWITCHES

The normal standard type is known as the front connected pattern and is for use as a loose unit or for mounting above or below ducts or busbar Chambers. The catalogue prefix is "CH" or "CS" according to whether the switch is fused or not.



CH36N

BACK CONNECTED PATTERN SWITCHES



CH320N/B

This pattern is the standard switch provided with insulated screwed stems protruding through the back of the switch complete with locknuts. This type is for mounting on the front of cubicles so that connections of either cable or solid copper can be made to the back of the switch inside the cubicle. The catalogue prefix is CH—/B or CS—/B.

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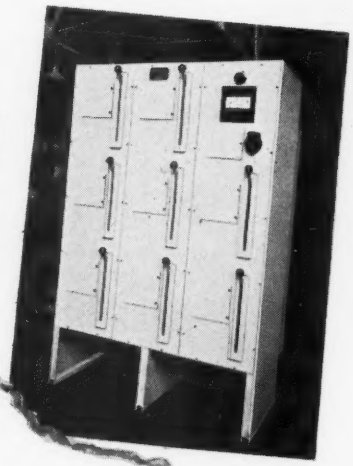

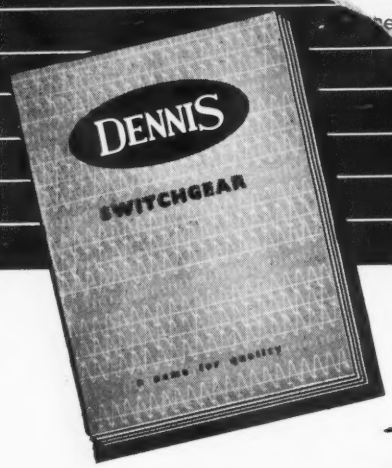

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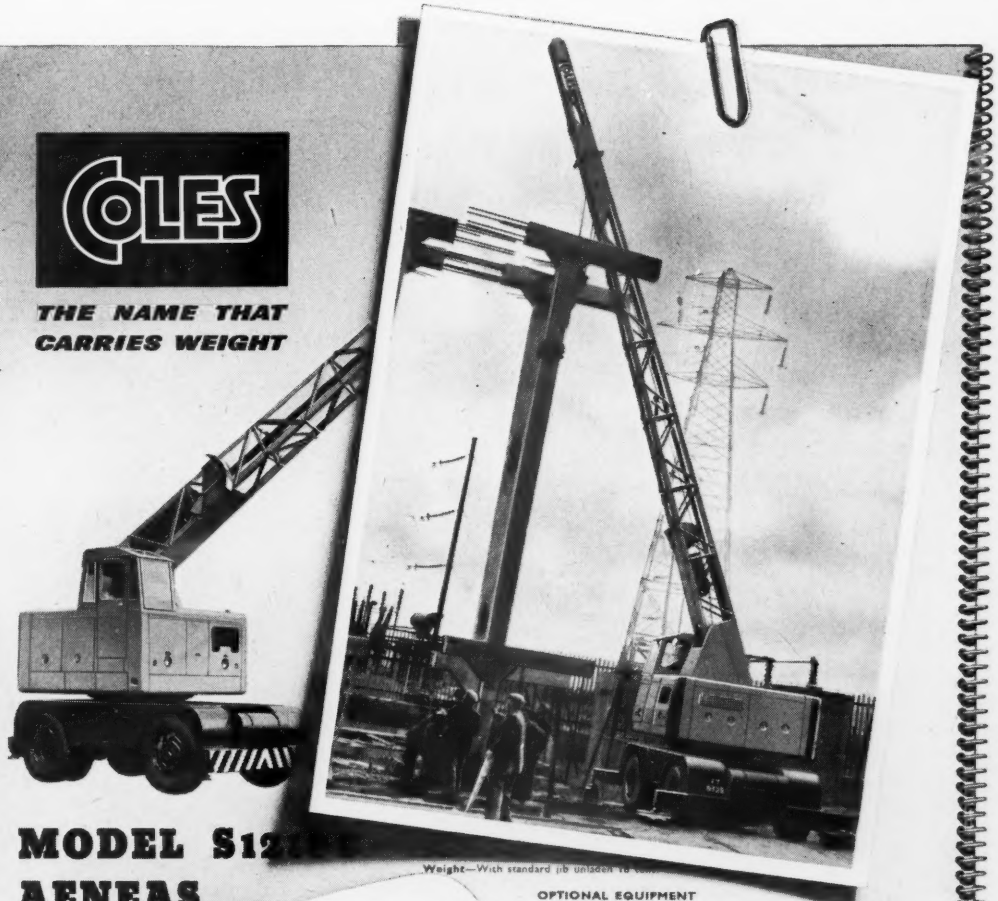

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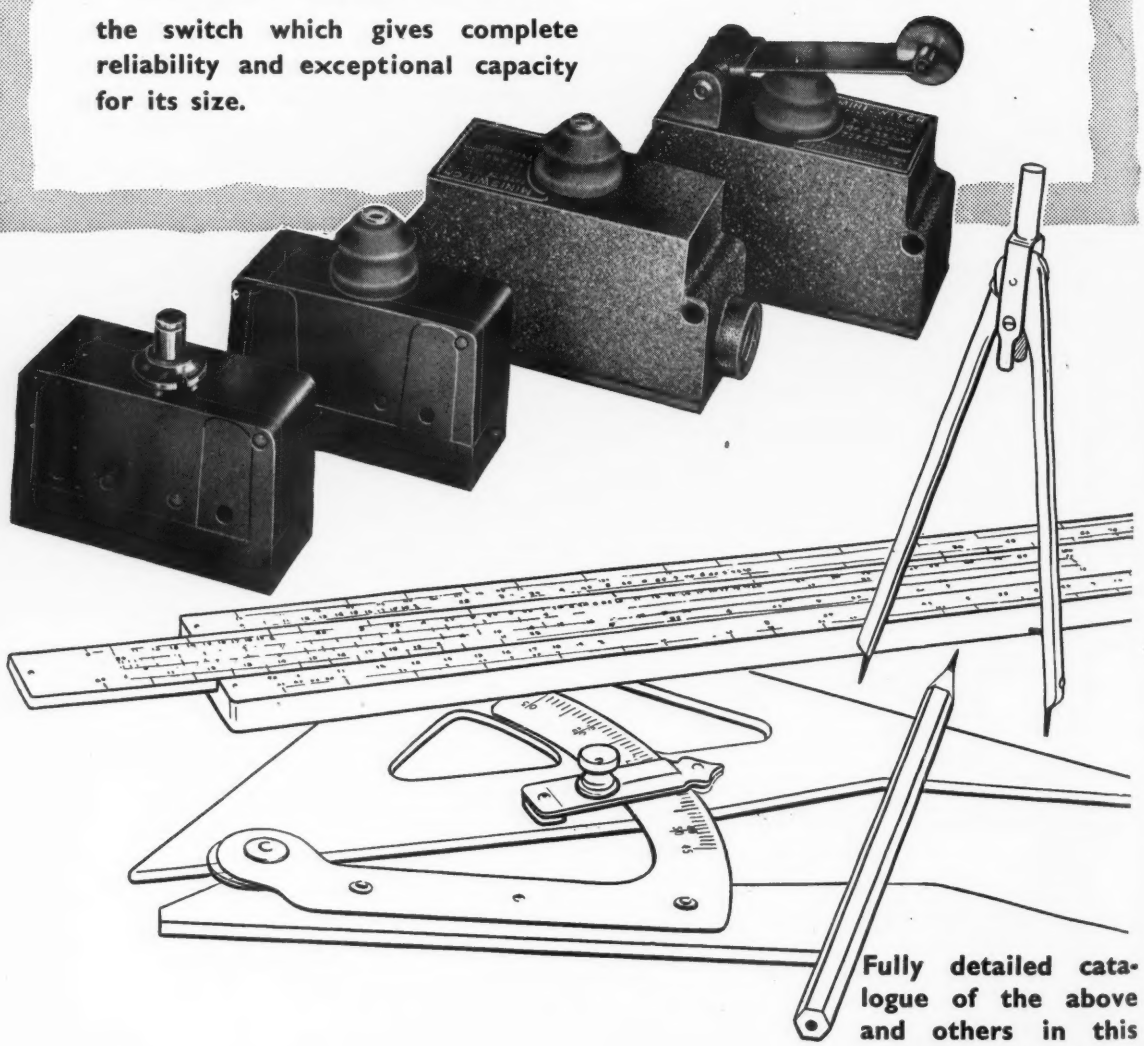

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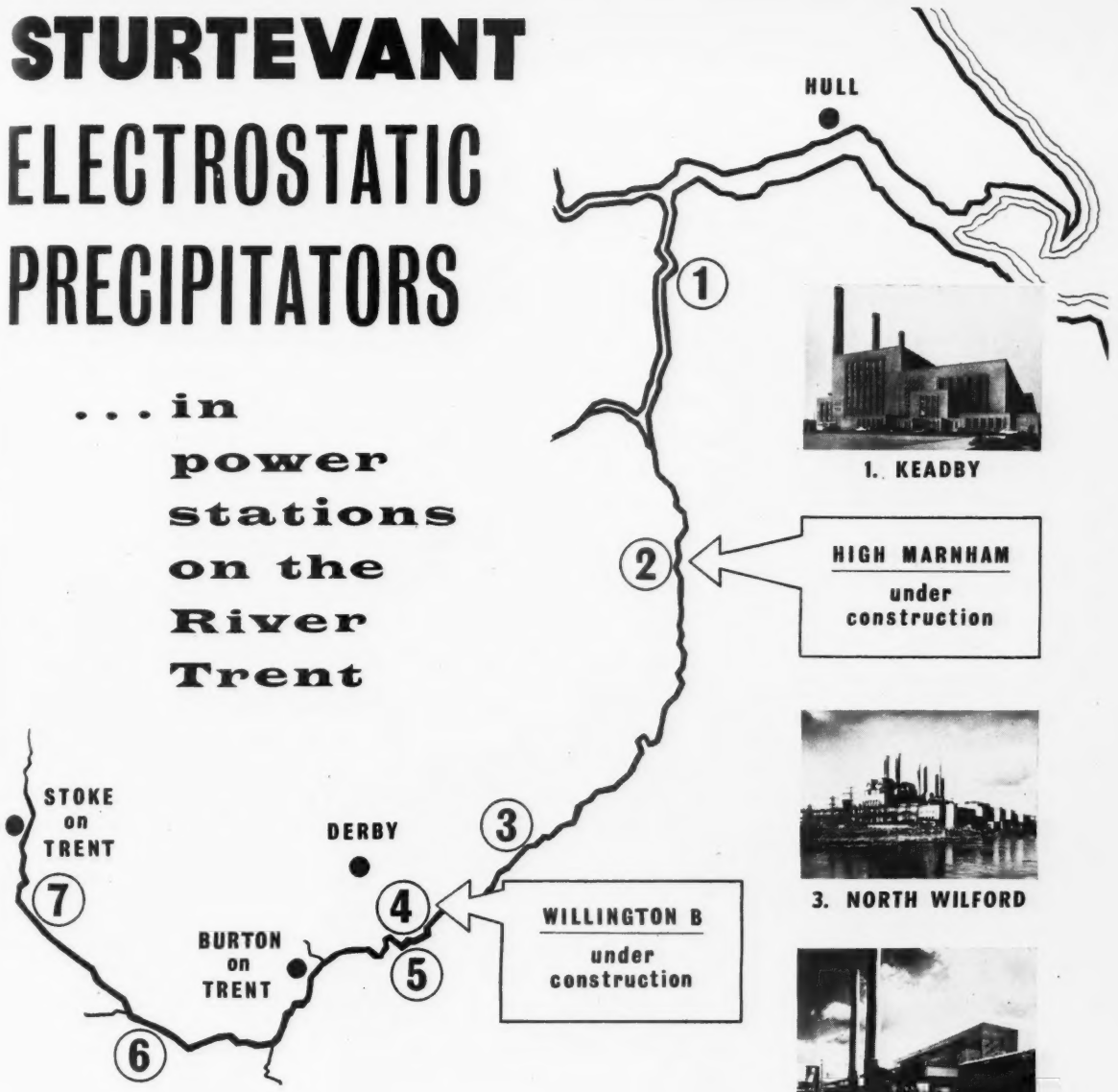

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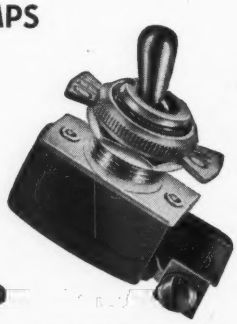

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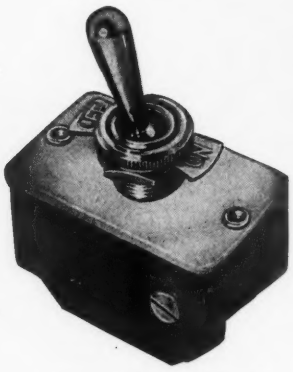

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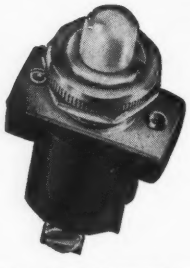

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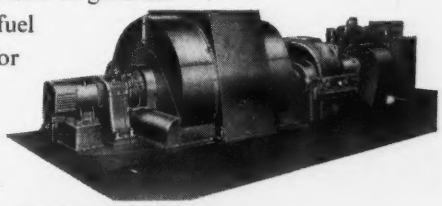

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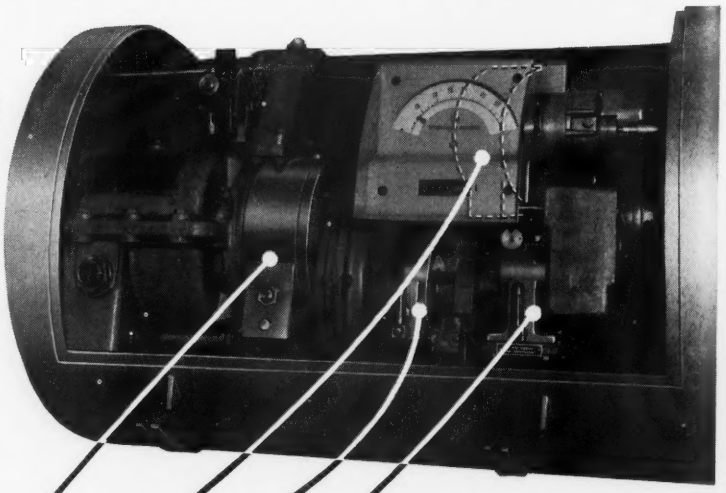

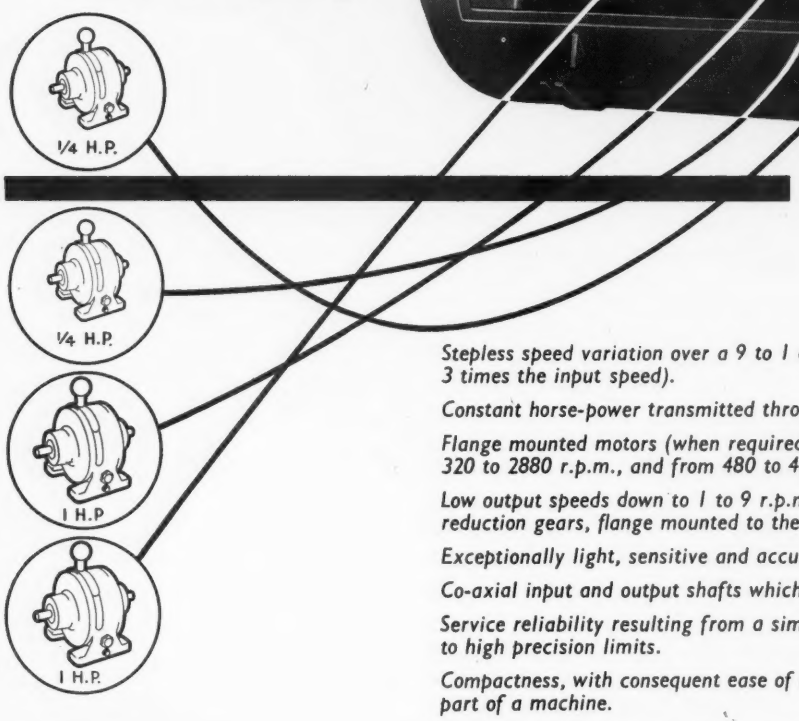

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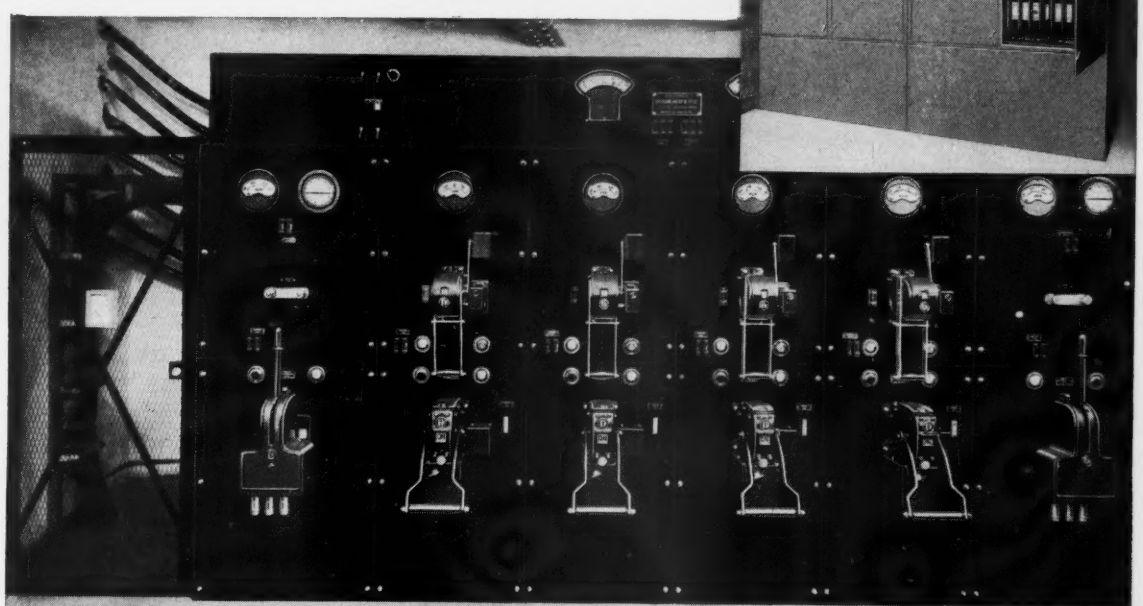

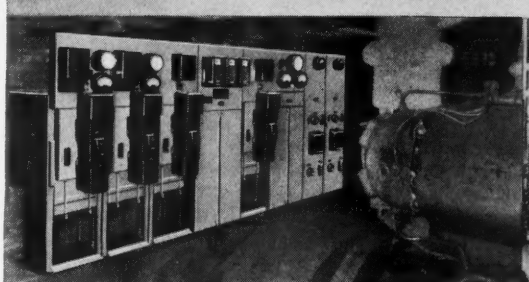

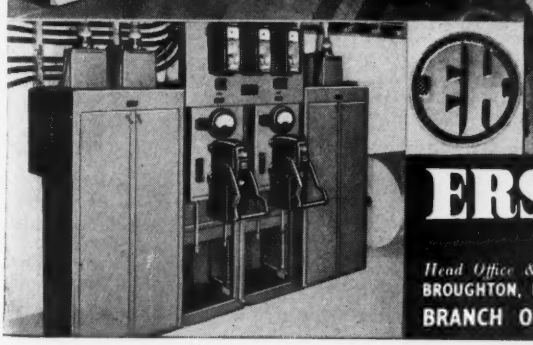

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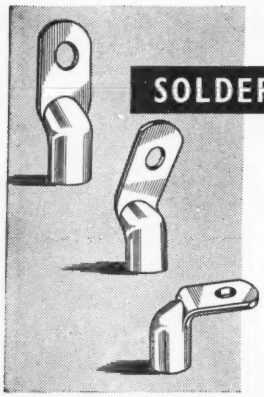

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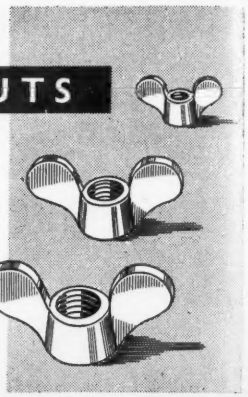

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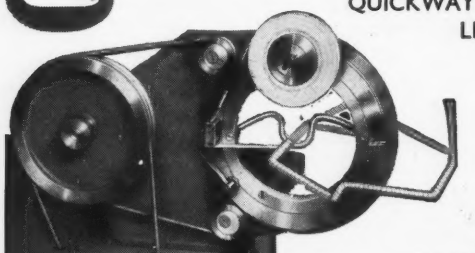

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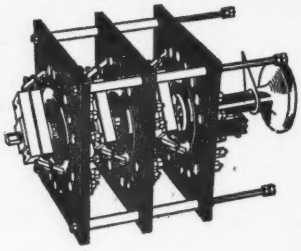

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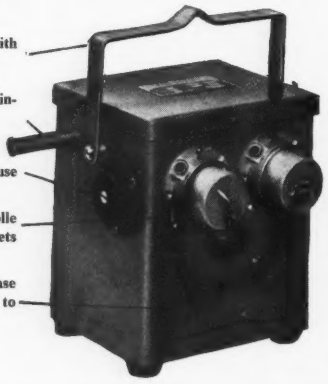

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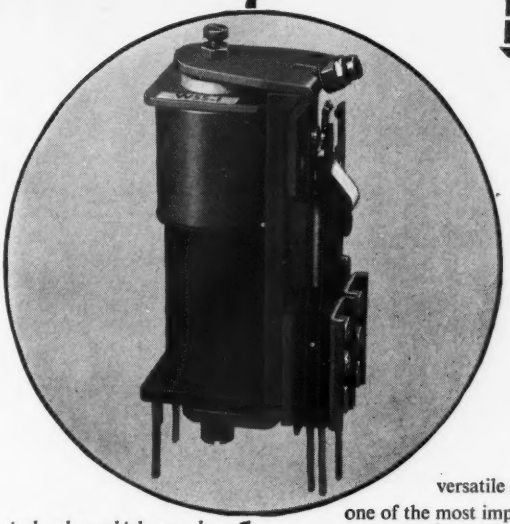

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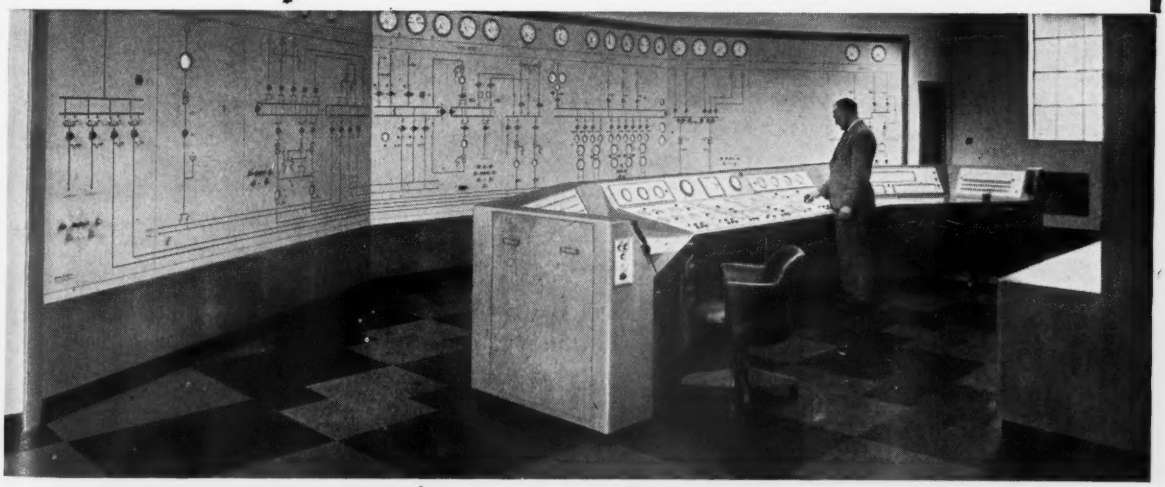

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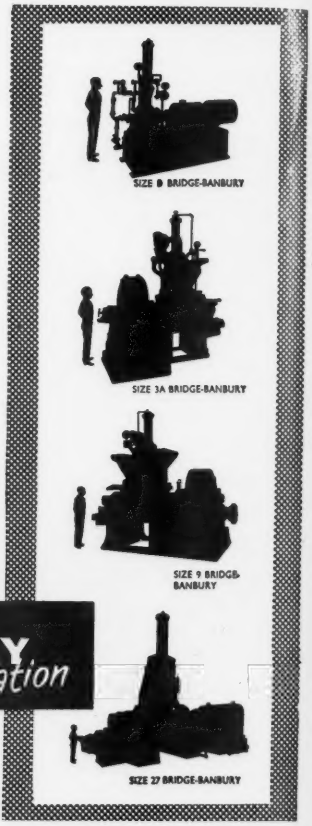

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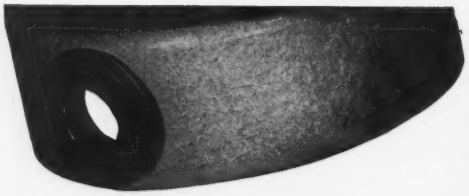

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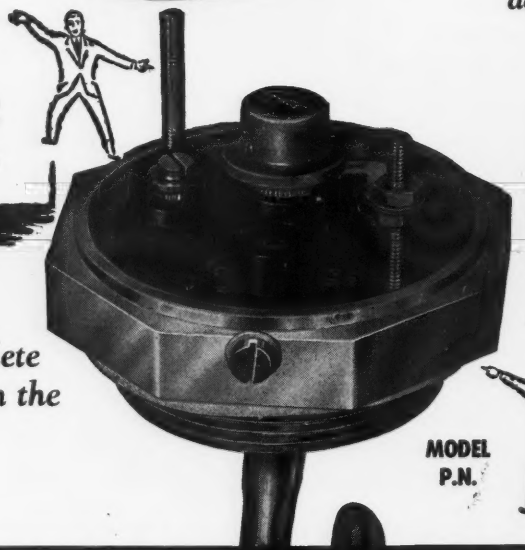

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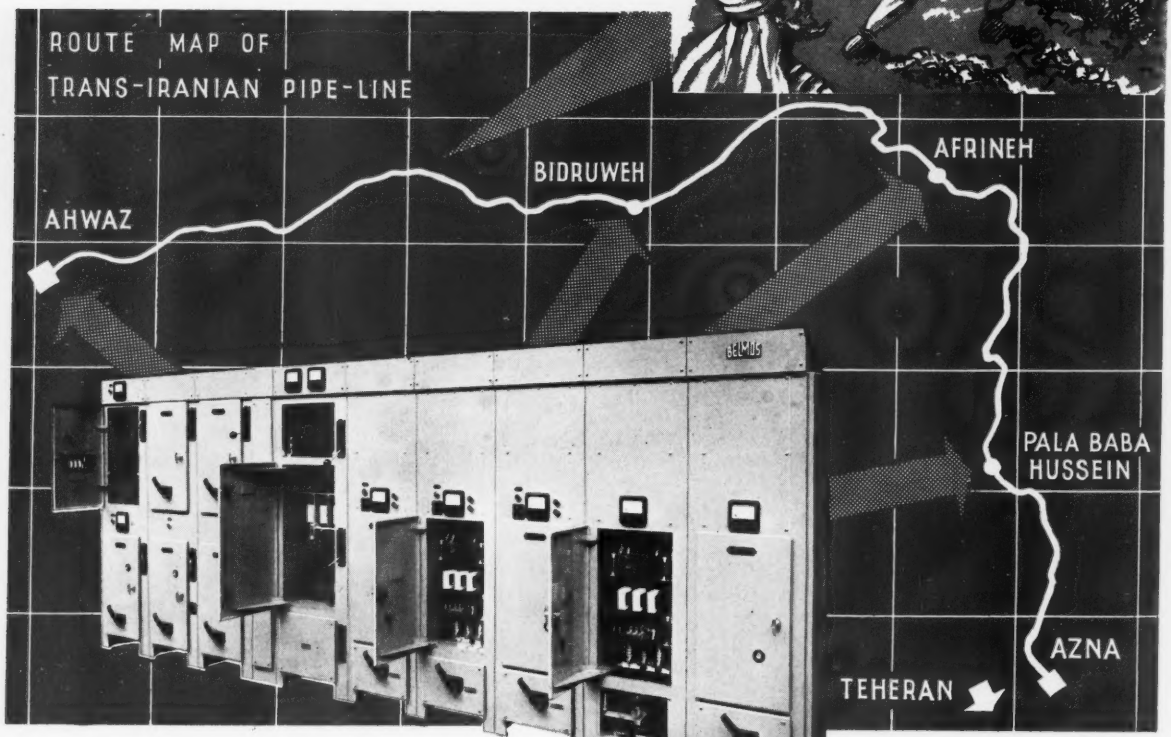

Running for 300 miles, the Trans-Iranian oil pipeline connects the town of Ahwaz (a focal point of the existing crude oil pipeline system of sixty miles north of Abadan), to the town of Asna, forming the southern part of a project which, in all, will stretch from Abadan to Teheran ; the line from Abadan to Ahwaz being already in existence, while the Northern section from Asna to Teheran is being laid by a French firm. The completed pipeline will cover some 580 miles and will convey Gas Oil, Kerosene and Motor Spirit.

There are four pumping stations between Ahwaz and Asna, each station being similar in engine capacity (1,500 h.p.). The main control gear for the electrically operated pumps and compressors at each station comprises a Belmos Group Control Board of the industrial type with appropriate remote control stations—the latter including flameproof units at hazardous locations.

Much of the pipeline crosses difficult mountainous terrain, reaching a height of nearly 7,000 feet above sea level. The present stage has a capacity of 1,000,000 tons a year and provision has been made for doubling this, together with extra pumping stations.

The Control Board shown is typical of the four supplied, and comprises an incoming air-break circuit breaker, five stator/rotor starters for slip ring motors, and four direct-on line starters for squirrel cage motors, with an additional feeder circuit at AHWAZ only.

Acknowledgements :

We are indebted to Messrs. Costain-John Brown Ltd., who designed and constructed the pipeline project as main contractors, for permission to use the information given.

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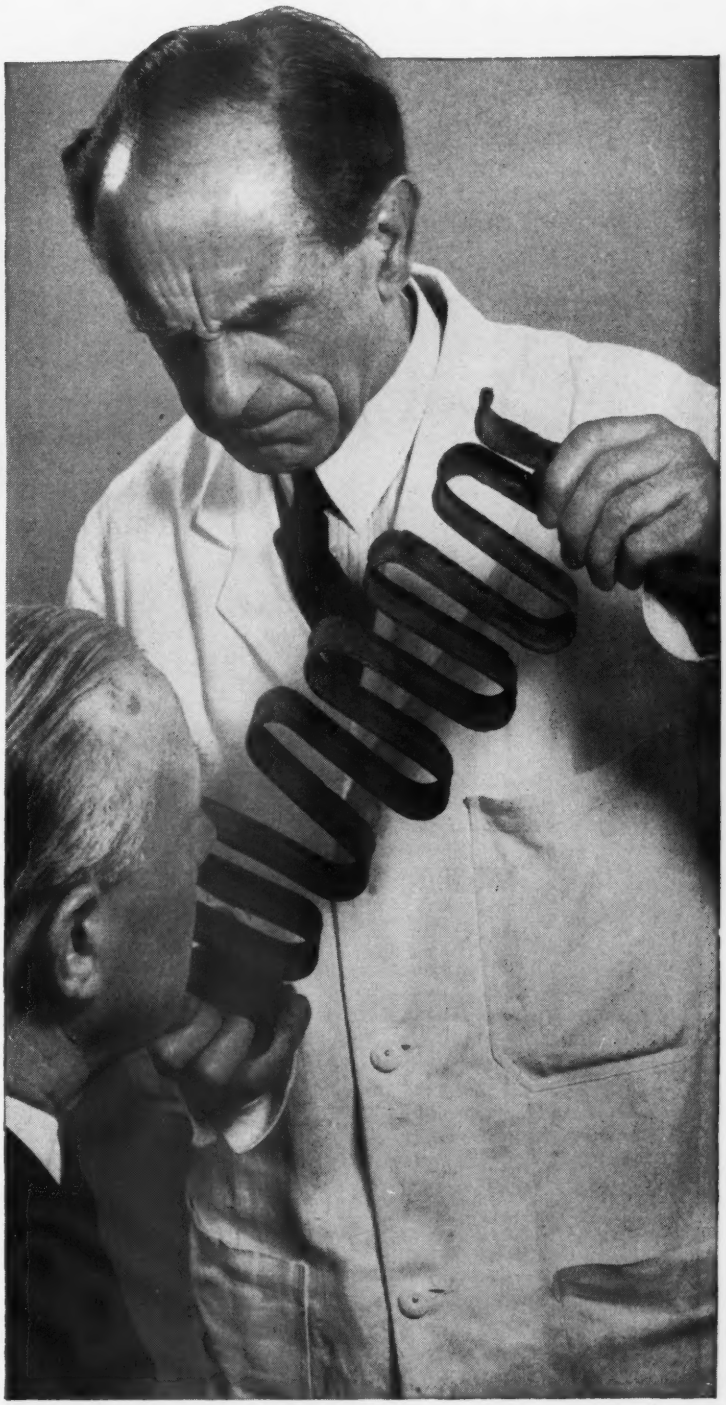
Mr. Finch is forbidding when he's roused



He's a quiet type normally, all wrapped up in productivity. But when his production line is brought to a standstill by the premature failure of a furnace element, in he rushes to the Buyer's Office. 'Look at this element' he says, and then it starts . . . .

It's little use for the Buyer to protest that he only orders the elements—Mr. Finch is formidable in this mood and, of course, he's right. Correct choice of the most suitable resistance material would have ensured dependability and long life. That is why so many furnace manufacturers use one of the Brightray Alloys for their elements.

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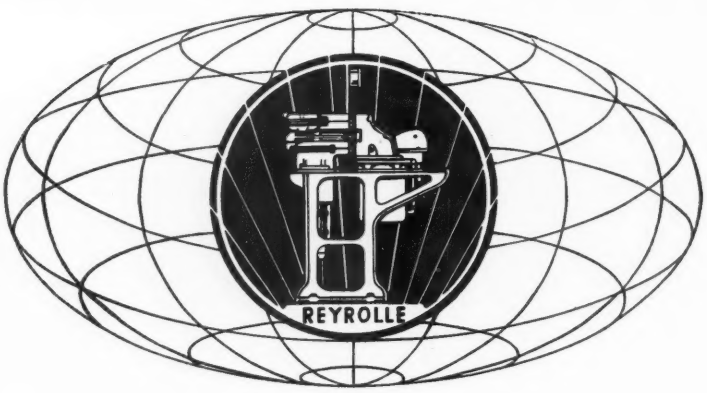

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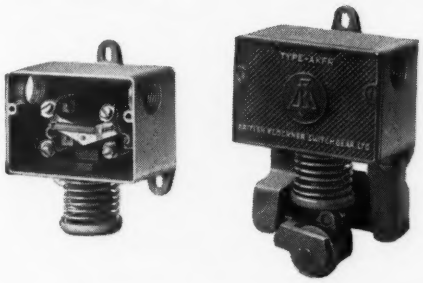

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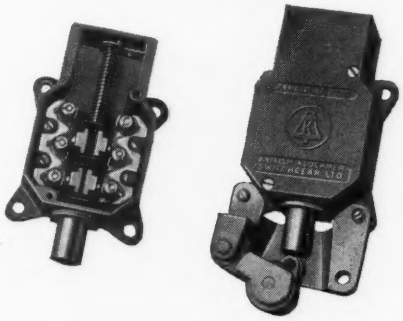

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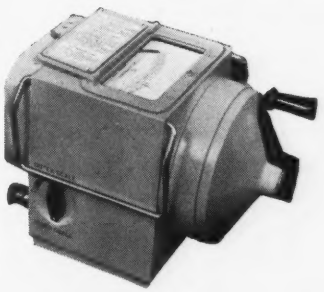

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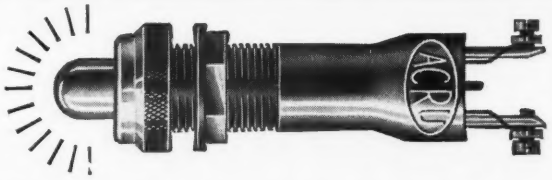

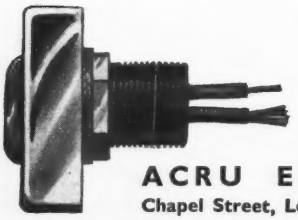

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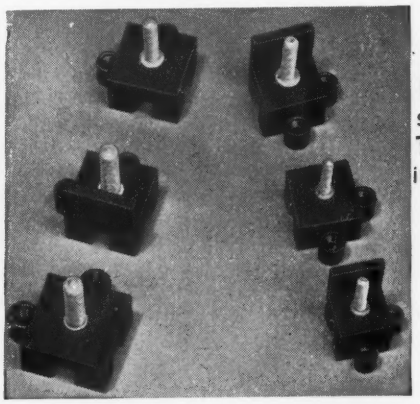

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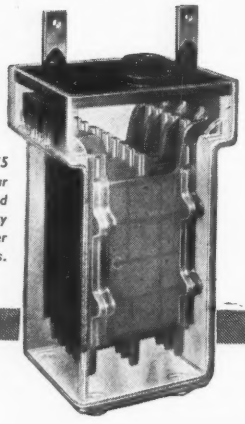

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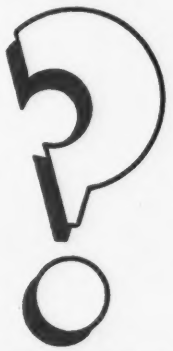

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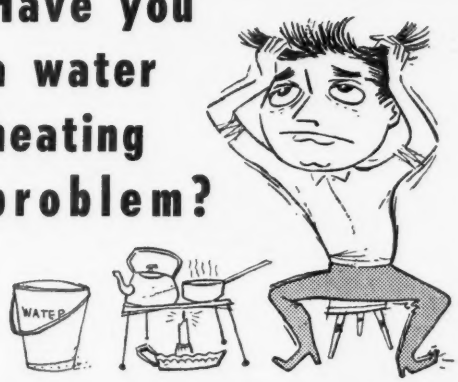

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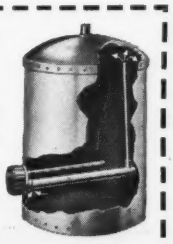

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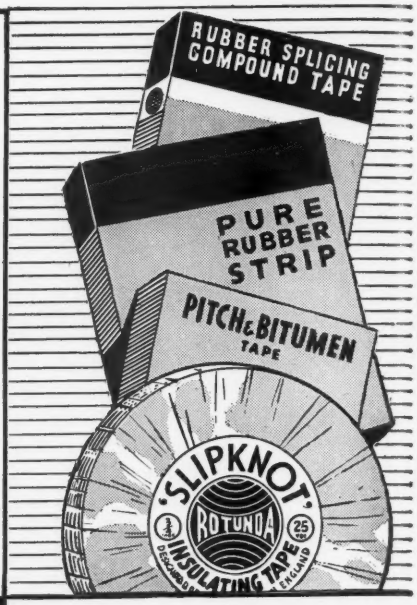

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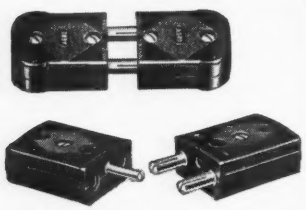

No. 8280 (above) — Flex Connector (brown bakelite) 5 amp 2 pole.

No. 8290 (below) — Flex Connector (brown bakelite) 5 amp 2-pole and earth, non-reversible. Earth pin assembled in socket half to prevent accidental insertion into live sockets.

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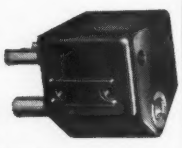

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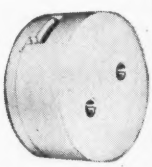
No. 8260 — Bi-pole Connector (cream bakelite) for use with fluorescent tubes with bi-pin caps.



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No. 8740—Combined Plug Adaptor (brown bakelite) 5 amp 2-pole to B.C.

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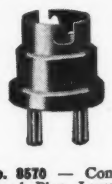

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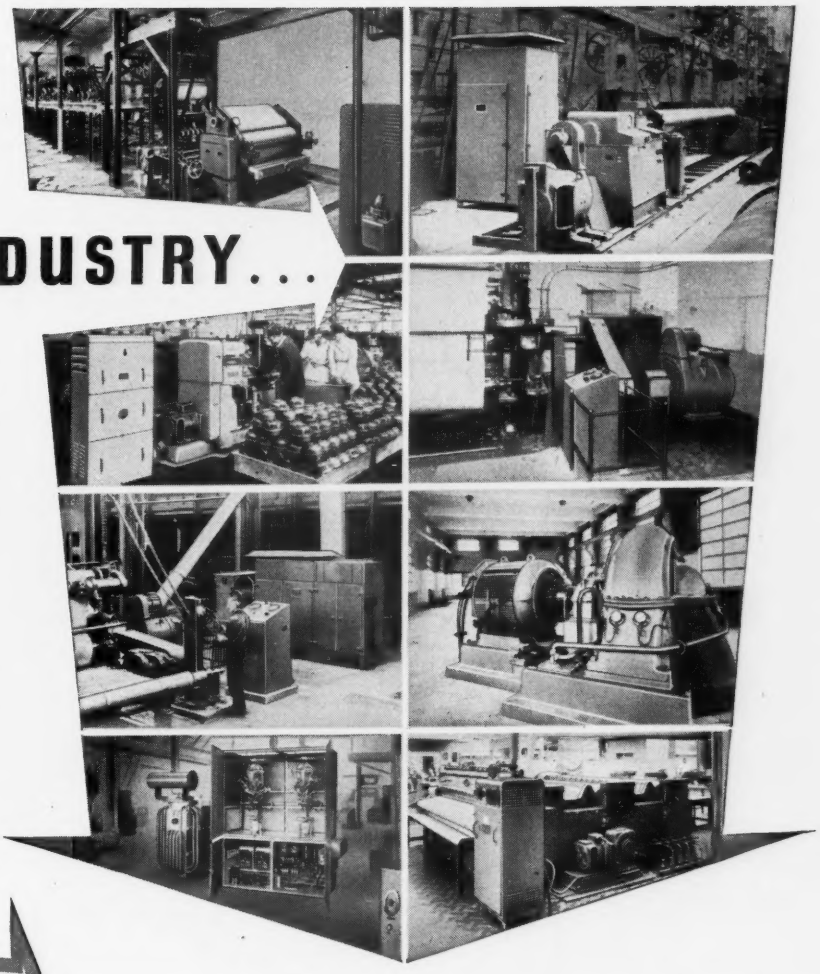

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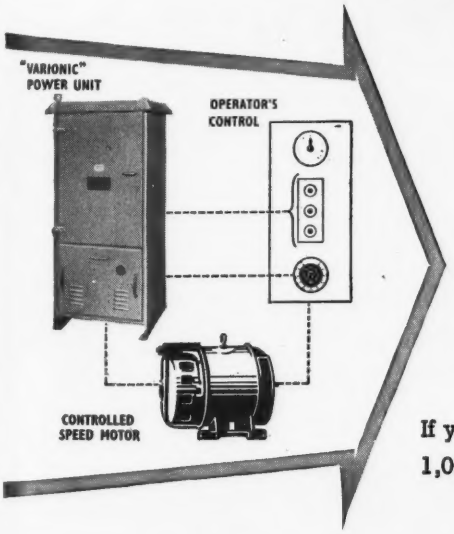

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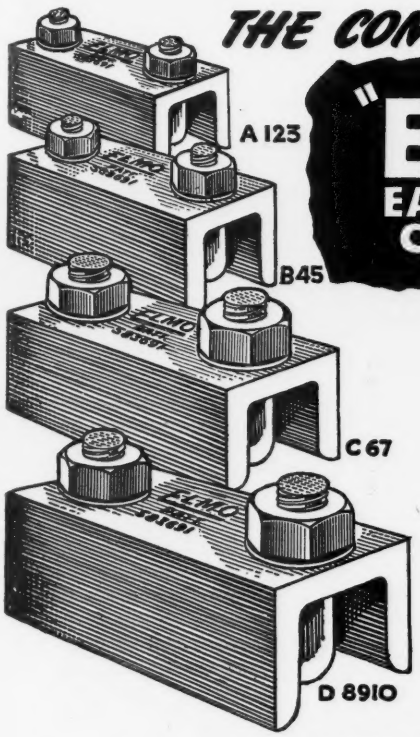

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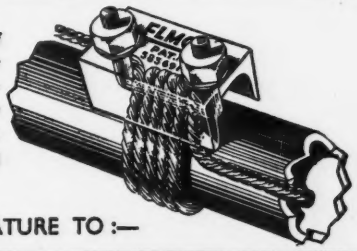

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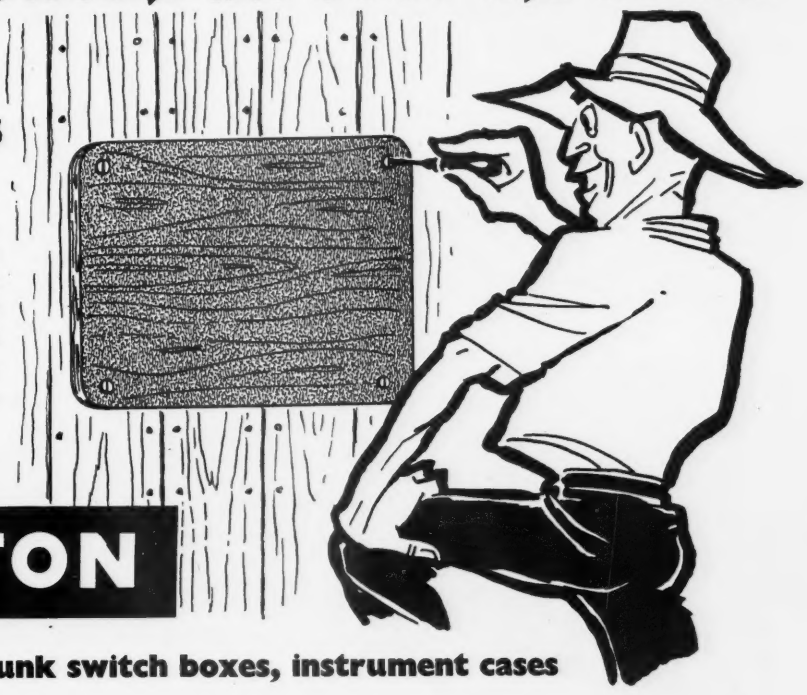

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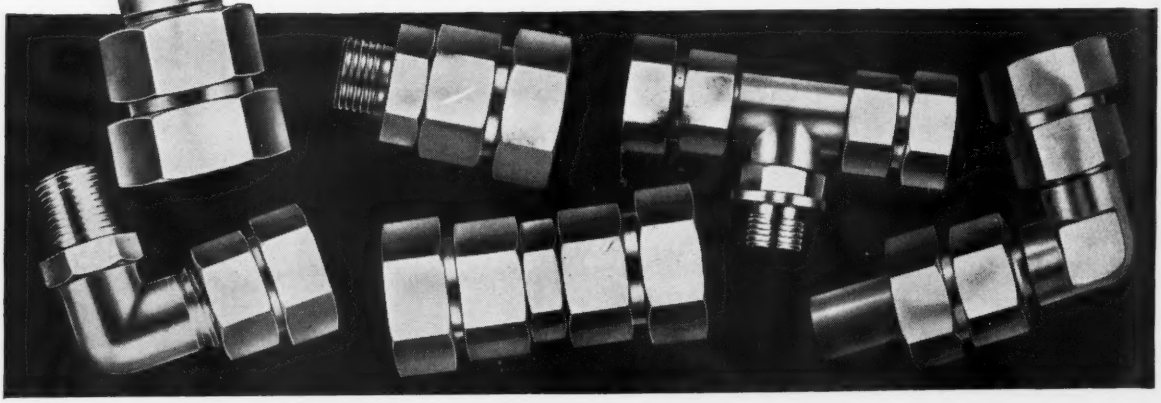

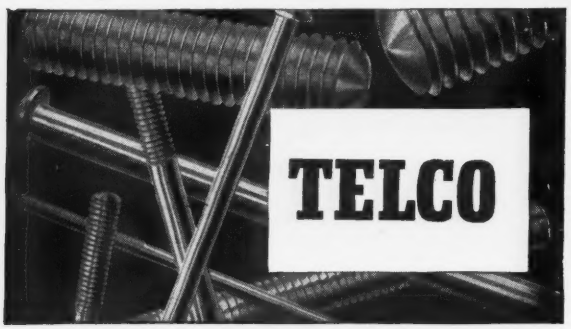

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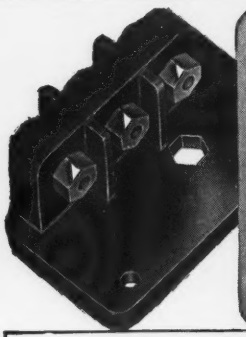

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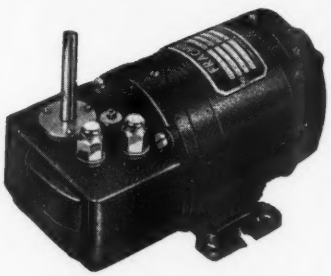

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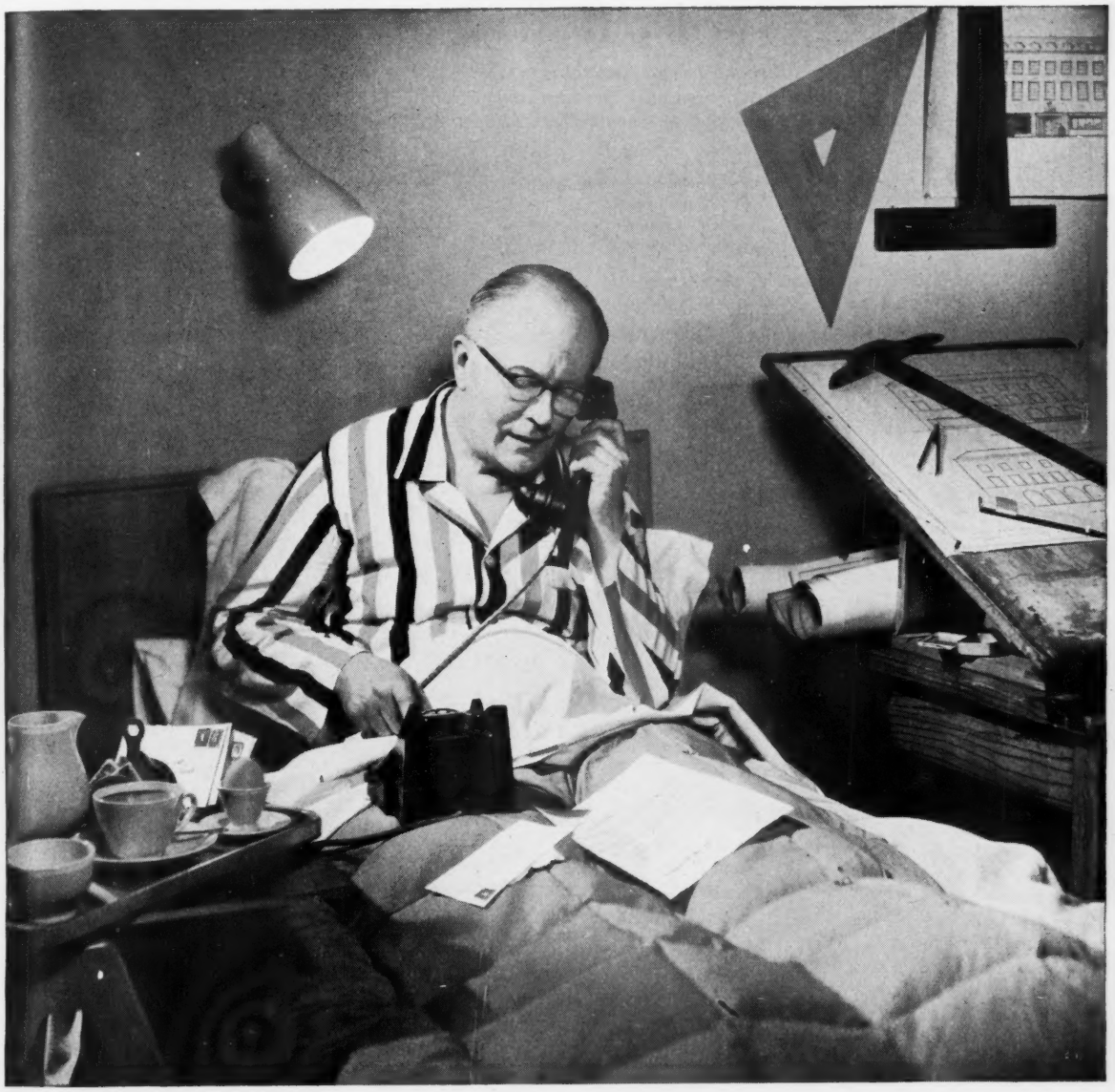

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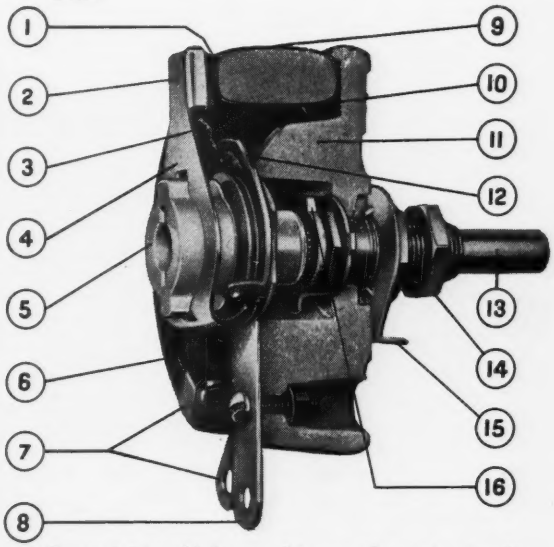

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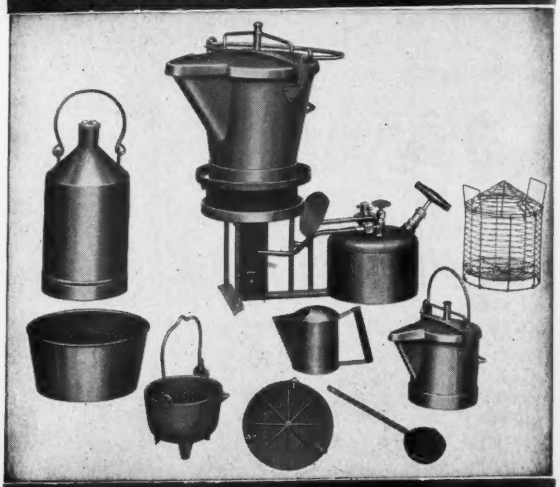

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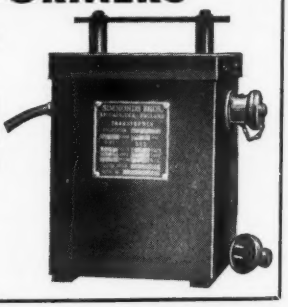

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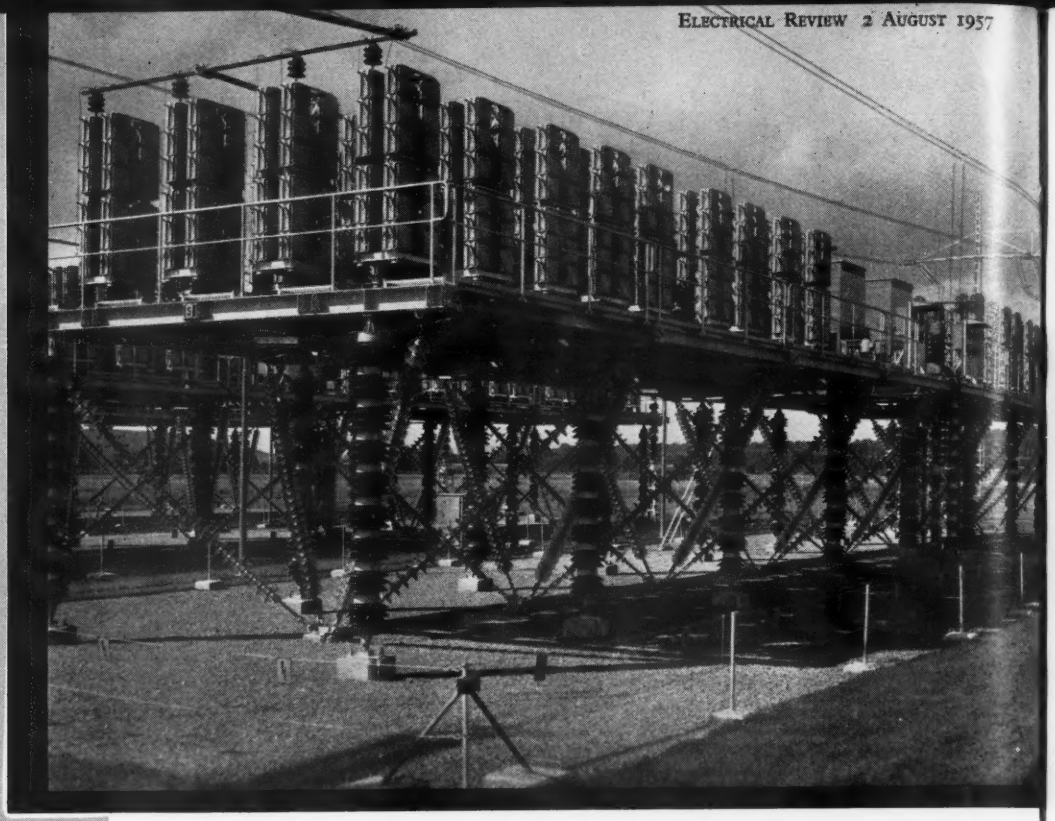

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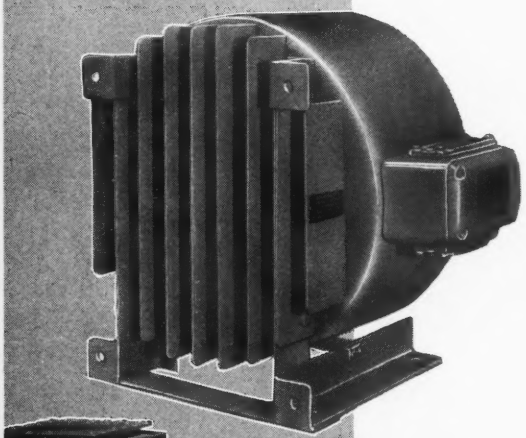

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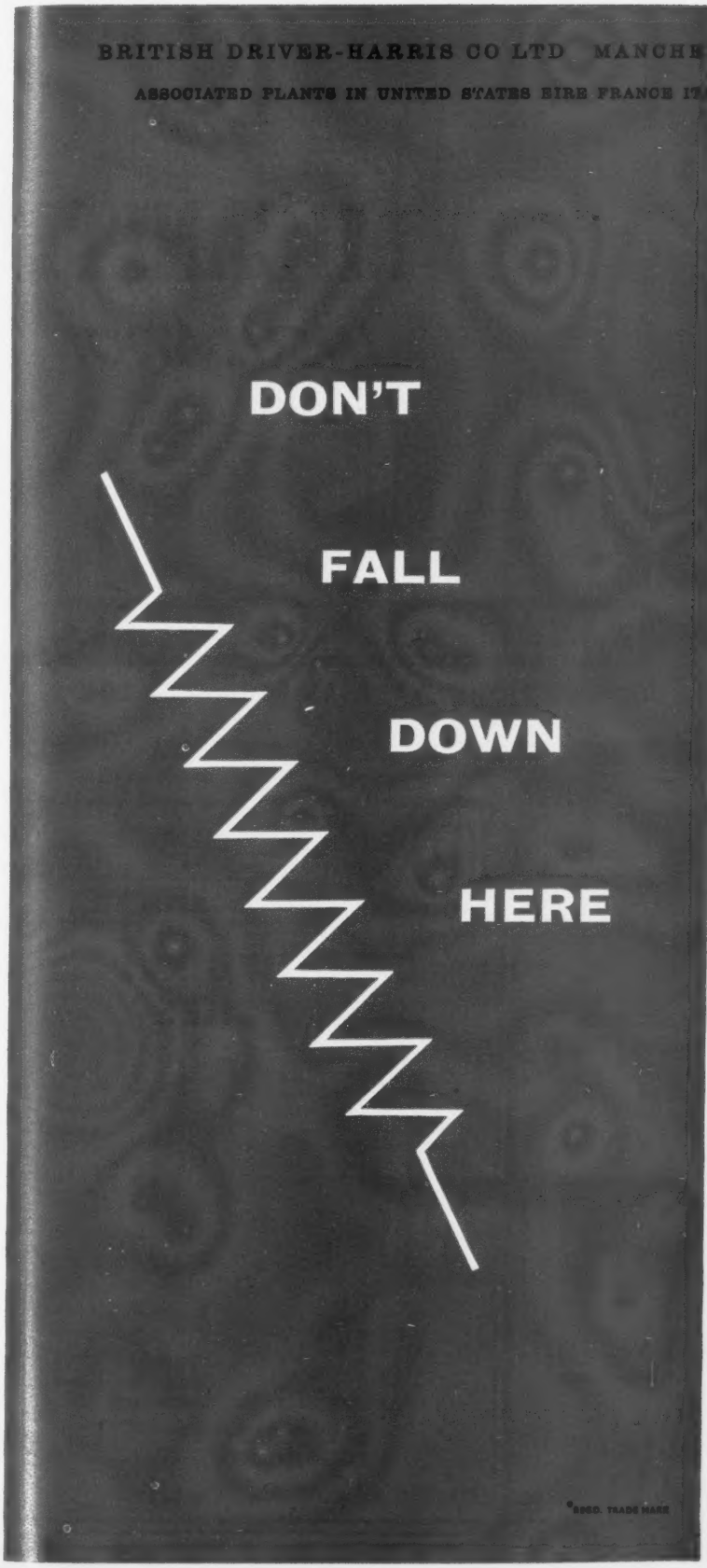

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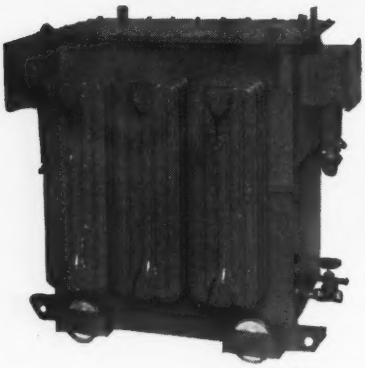

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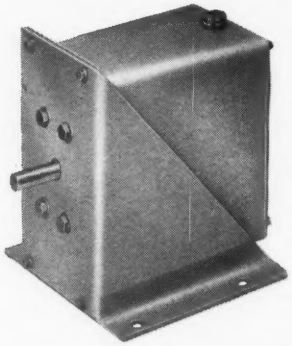

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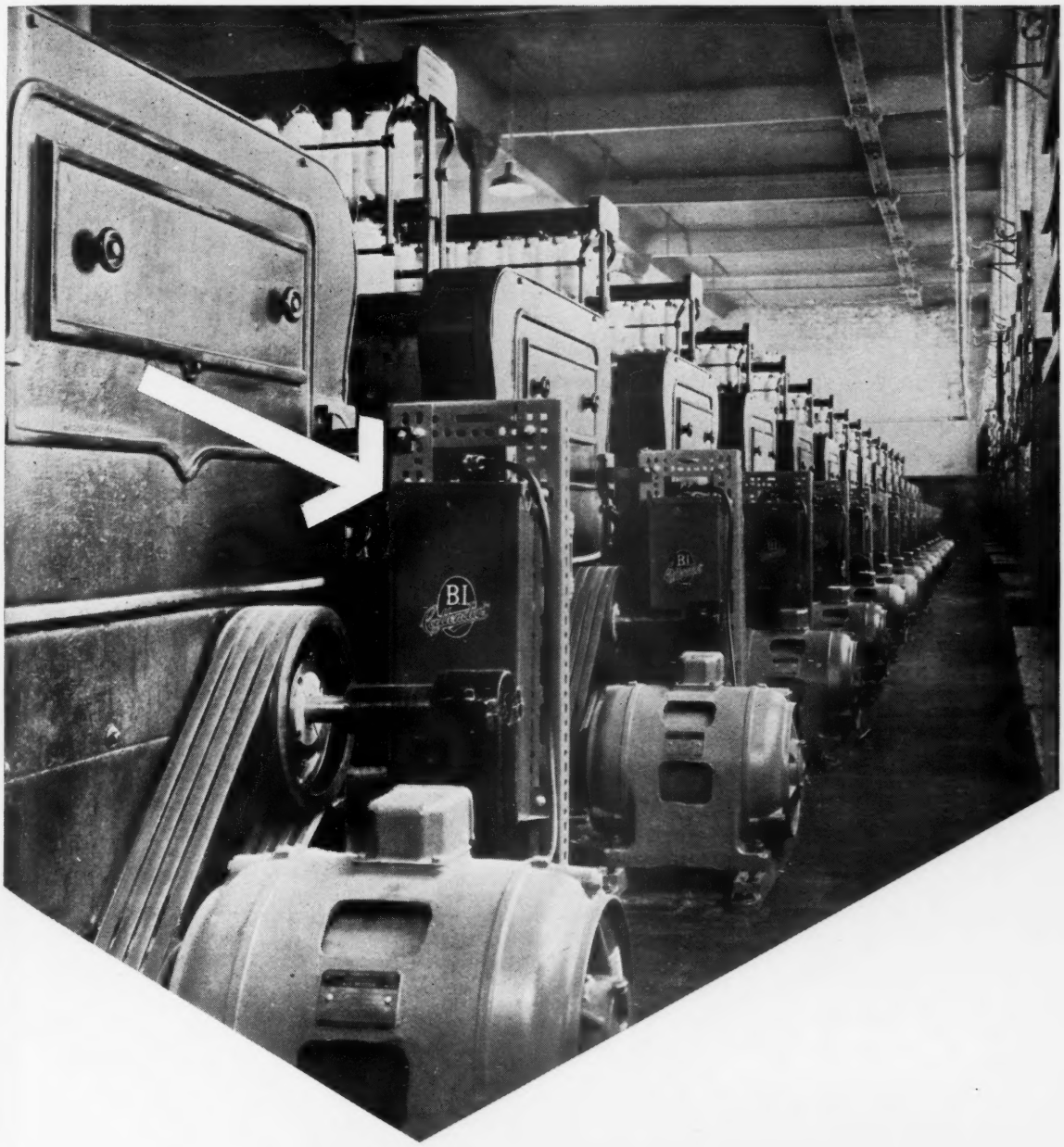

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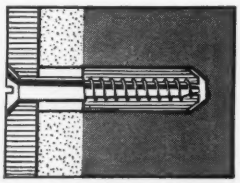

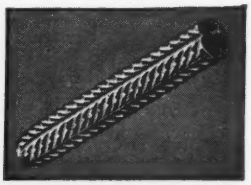

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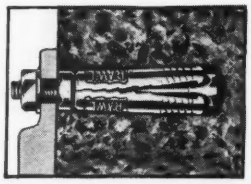

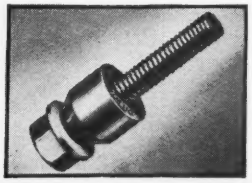

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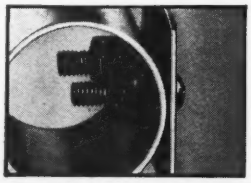

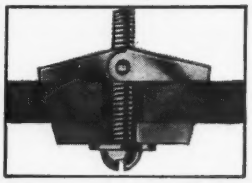

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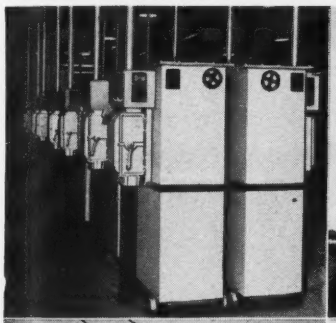

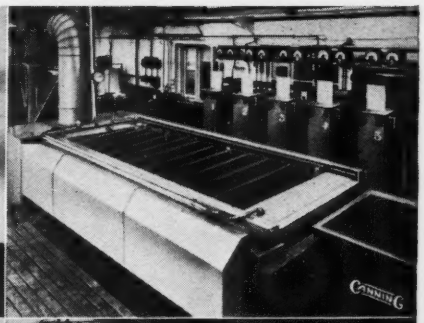

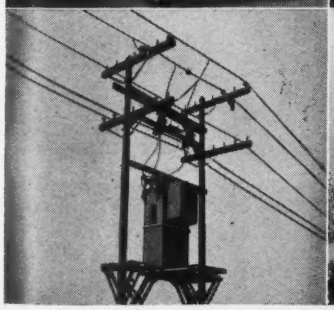

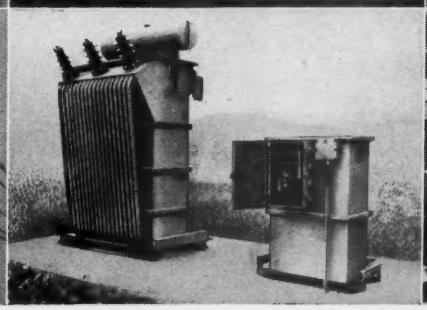

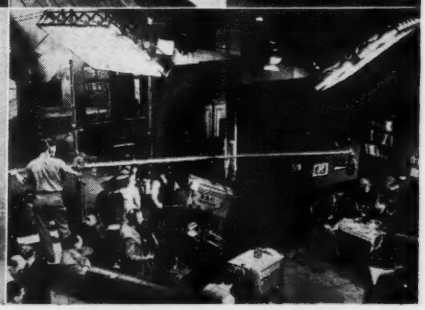

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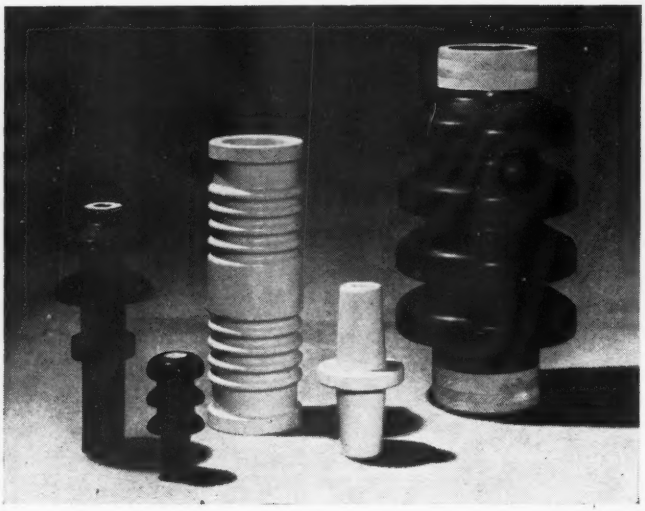

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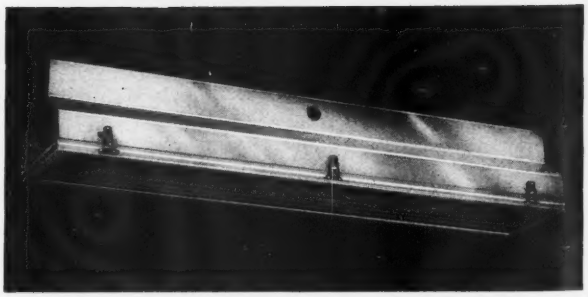

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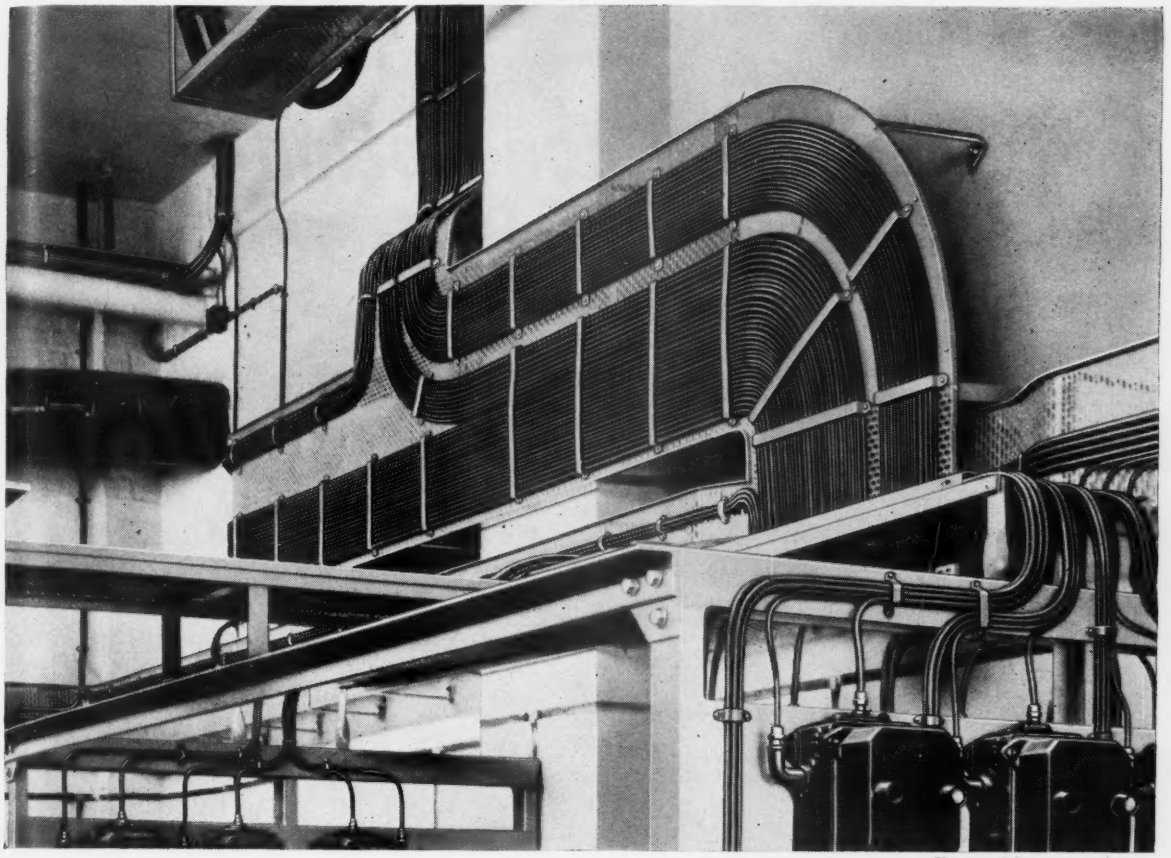

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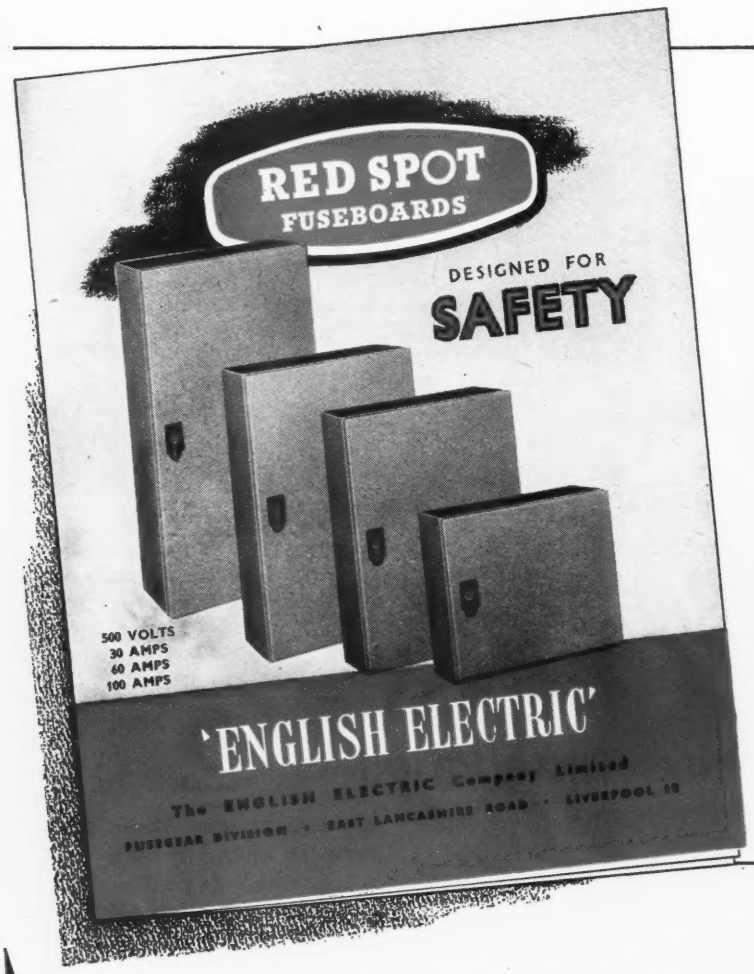

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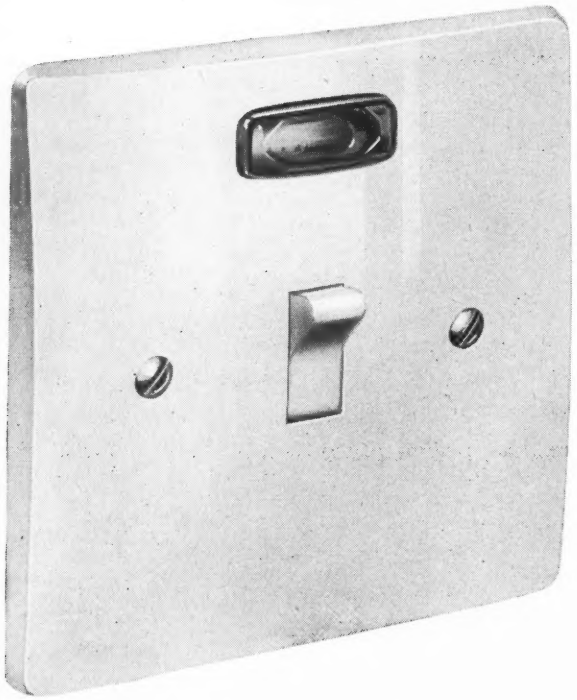

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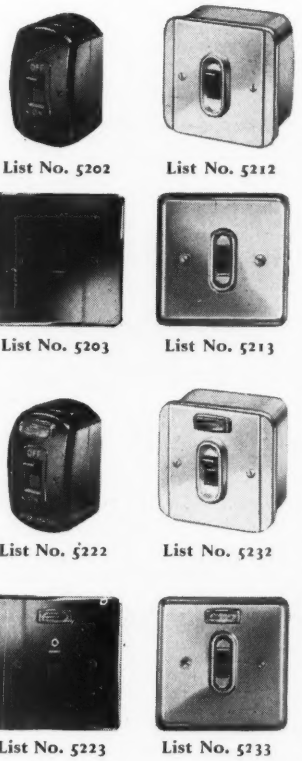

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2 AUGUST
1957

ELECTRICAL REVIEW

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VOLUME 161 NUMBER 5 ✧ *Eighty-Fifth Year of Publication* ✧ FRIDAY PRICE 1s 6d

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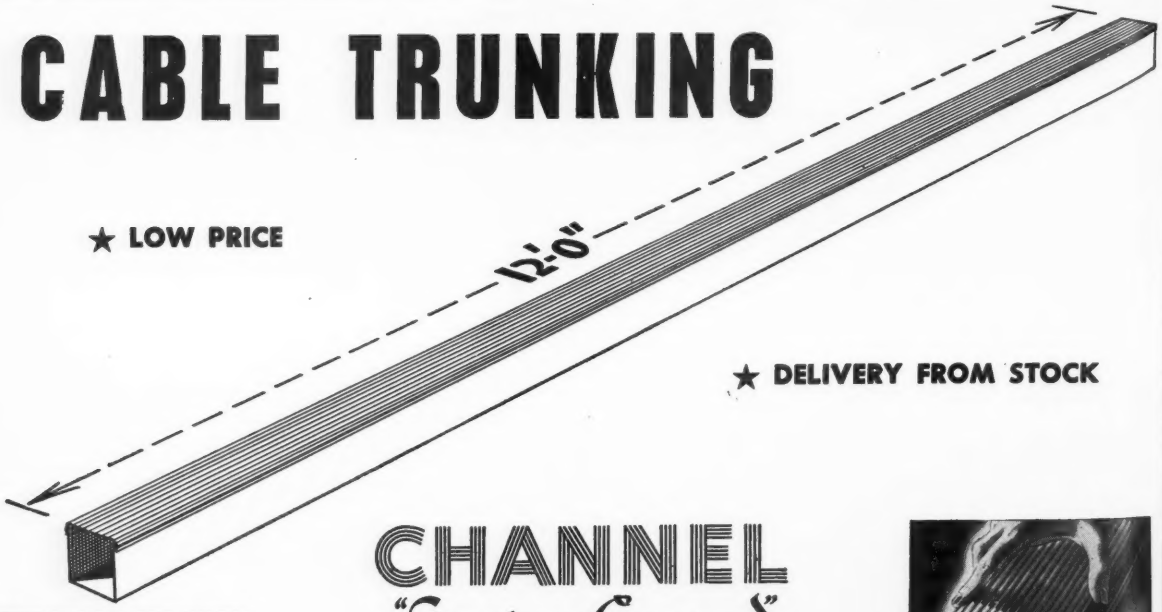

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ELECTRICAL REVIEW

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Nuclear Power Progress

THE third annual report of the United Kingdom Atomic Energy Authority, which we summarise in this issue, emphasises the fact that this country is taking the fullest possible advantage of its lead over other countries in the field of nuclear power and is pursuing a vigorous programme of research and development to ensure that the maximum benefit is derived from the exploitation of this new form of energy. The past year has, in effect, seen the birth of nuclear power with the opening of Calder Hall in October by H.M. the Queen, and the placing of contracts for the much larger and more advanced nuclear power stations of the same basic type, which are to be built for the Central Electricity Authority and the South of Scotland Electricity Board.

Co-operation between the U.K.A.E.A. and the industrial groups formed for the express purpose of designing and constructing nuclear power plants has been of the highest order, and the enthusiasm with which all concerned have approached their problems has undoubtedly been a major factor in allowing expansion of the " White Paper " programme from 1,500–2,000 MW to 5,000–6,000 MW. Thus the placing of contracts for the building of the first nuclear power stations for the electricity authorities marked a significant stage in the translation of the United Kingdom's civil atomic energy effort from the status of a Government research and development project to that of a full industrial realisation.

Apart from assisting and guiding the " consortia " in connection with their design problems, the U.K.A.E.A. has disseminated a great deal of information, especially within industry, as widely as is compatible with the national interest, and has devoted a substantial effort to this end. After its excellent work in helping to lay the foundations of a new industry, the Reactor School at Harwell has moved into new premises, doubling its capacity and providing accommodation for 60 full-time students. Furthermore, to meet the demand for the training of reactor operators for nuclear power stations, a school has been set up at Calder Hall at which the course is complementary to that of the Harwell Reactor School.

The present annual report shows a considerable expansion of effort in connection with reactor research and development, some measure of which can be gauged from the fact that during the year about 3,000 additional employees were engaged. The reactor research programme has been under constant review, and in the light of developments within the past year the concept of three successive stages has been abandoned in favour

of a more flexible pattern which should lead to a more rapid translation of ideas into practice. This is largely because the Authority's primary object is to develop reactors offering the prospect of producing the cheapest electrical power and some of the more advanced systems now show greater potentialities for development than others. The Authority's achievements during the past year have been many and varied and it is to be congratulated in more than fulfilling its task.

THERMAL AND COMMERCIAL EFFICIENCY

Fuel cost is only one component of the total cost of generation of electricity, and thermal efficiency, although very important, is not the sole criterion in the design of a power station. Papers written on power stations commonly tend to overestimate the advance in thermal efficiency given by the technical features usually described therein.

This statement appeared in a paper " Coal and Oil Fired Power Stations " by F. H. S. Brown and E. S. Booth presented at the British Electrical Power Convention (see *Electrical Review*, 21st June) and it confirms our contention that, useful as they are, the statistics and lists received in one form and another from the public electricity supply authorities a few times every year do not give the fuller guidance that most electrical engineers need. What would be more useful is a figure of commercial efficiency for a power station rather than one tied to thermal efficiency, and we say this with full appreciation of how closely the two terms are linked.

ELECTRICAL EXPORTS

The figures published by the Board of Trade of British electrical exports show that for the first half of this year there has been a considerable improvement as compared with the corresponding period of 1956. While in one or two months there were apparent setbacks, the falls were more than offset by increases in the good months. It is to be expected that these fluctuations will occur, especially where heavy electrical plant is concerned, as the fulfilment of a single contract may well increase the month's figure by several thousands of pounds. The overall picture for the first half of the year shows that there is no slackening in the demand for British electrical products.

The largest importer of British electrical equipment in the first half of the year was India, whose total purchases of £12·5 million were £1·8 million up on the corresponding period of 1956. Next came Australia with £10·1 million; South Africa with £8·9 million; and the United States and Canada both with £6·4 million. The Netherlands headed the list of European customers with £4·1 million.

THE CANADIAN MARKET

European free trade and the Common Market have in recent weeks somewhat overshadowed prospects in other parts of the world. It was therefore useful to be reminded last week by Mr. Derek Walker-Smith, the Minister of State, Board of Trade, of the importance which the Government attaches to the development of trade with Canada which, he said, was a market with " tremendous potentialities." The occasion was the return of an economic, technical and goodwill mission sponsored by the Council of British Manufacturers of Petroleum Equipment led by Mr. J. M. Storey. Although it was concerned particularly with equipment for the oil and petro-chemical industries, some attention was devoted to British exports generally. It was pointed out that present circumstances are particularly favourable and in reply to a question Mr. E. C. Whiteley (Metropolitan-Vickers), one of the members of the mission, said that in the next few years there would be a very great expansion in the installation of thermal generating plant in Canada, a type of plant of which Britain was at present the principal supplier.

Certain pre-requisites of success in the Canadian market were mentioned, such as local representation, personal approach and after-sales service. The Canadian engineer, Mr. Storey said, was anxious to buy from Britain but it was important to understand that he was not willing to wait for what he bought—in fact he wanted it " yesterday." Business was more likely to be obtained on the telephone than by letter.

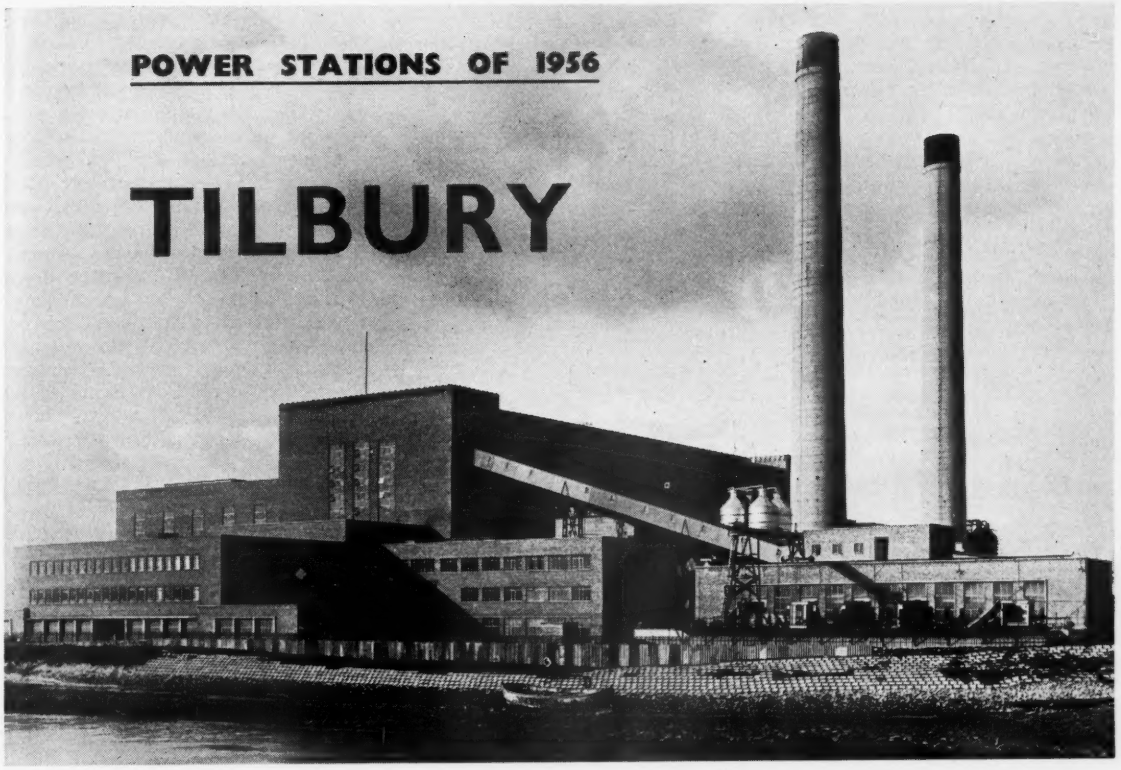
DEARER STEEL

The increased maximum prices of iron and steel products announced last week obviously represent a serious additional cost to manufacturers and it is not much consolation that, as the Iron and Steel Board points out, United Kingdom plates, sheets and tinplate are still relatively cheaper than those of other main steel producing countries. Equally as important as price, however, is the ability of the industry to meet the growing demand for steel, and one of the factors taken into account in the increases is the need to provide for the industry's major modernisation and investment programme, details of which were also announced last week (see page 213). It is considered that the aim should be a productive capacity of 29 million ingot tons by 1962, compared with last year's output of 20·7 million tons. This will involve development expenditure of something like £600 million between now and 1961.

RELEVANCE AND STANDARDISATION

In his Charles Le Maistre Memorial Lecture on "The National Acceptance of International Standards" given to the International Electrotechnical Commission in Moscow, Professor R. O. Kapp said that a sense of relevance permeated the deliberations of the I.E.C. and gave its recommendations their value. One might search the text books in vain for help or guidance in mastering the technique of testing for relevance, he said, but the omission served largely to explain the many warring philosophies and the proliferation of rival " isms."

We agree with the Professor that no one would deny that truth and justice must be served punctiliously. A standard specification could be perfectly logical, comprehensive, clear, attractively worded and constructed in the most methodical manner, but it would still be useless if it had not been prepared with a due sense of what is relevant to the situation.



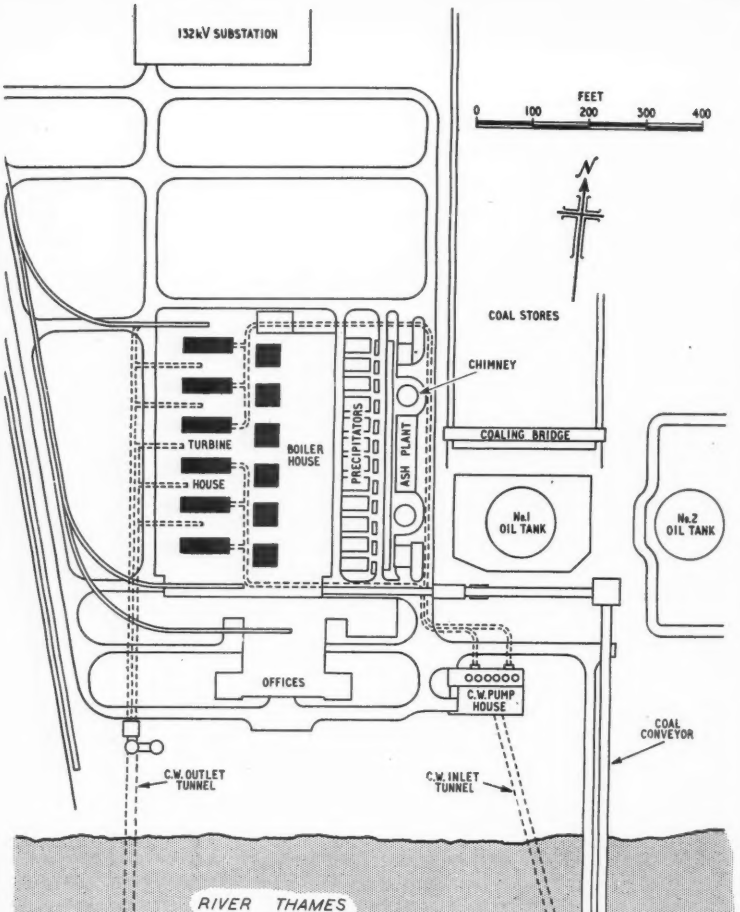
CONSTRUCTION PROGRESS ON 360 MW OIL/COAL-FIRED PLANT

WITHIN the last few weeks the fourth 60 MW turbo-alternator/boiler unit has been commissioned at the Tilbury power station of the Eastern Division, Central Electricity Authority. The complete installation will consist of six 540,000 lb/hr pulverised fuel boilers, arranged for alternative oil firing, each connected to a 60 MW turbo-alternator with steam conditions of 900 lb/sq in and 900 deg F at the turbine stop valve. When the plant is completed facilities will still exist for the building of a "B" station on the same site, although at present no definite plans have been made. The complete site covers an area of about 200 acres with a river frontage of 2,200ft on the north side of the Thames, some three-quarters of a mile below the Tilbury landing stage. The present station occupies the western half of the site adjacent to the river, with a 132 kV switching station to the north and a coal store to the east. The layout has been arranged so that a "B" station can be erected on the eastern half of the site, space having been provided in the north-east sector for a 275 kV switching station.

The site was originally flat agricultural land at a level of +5ft O.D. and this has been developed to a level of +10ft O.D. It is protected from the river by a bank which was originally at +15ft O.D., but since the floods in February, 1953, this has been raised to +19ft O.D. The subsoil consists of peat and silty material to an average depth of 45ft so all buildings have been founded on reinforced concrete piles driven to ballast at about −50ft O.D.

The main buildings are steel-framed structures clad in the familiar buff-coloured London stock bricks. The roof decking is of corrugated aluminium alloy sheeting covered with insulating material and granite chippings. The six turbo-alternators are arranged transversely in the turbine hall at 70ft centres and are served by 150 ton and 25 ton overhead gantry cranes with a span of 114ft. The steelwork is divided into 15 bays, each 35ft long, including a loading bay at each end. Between the turbine house and boiler house is an auxiliary bay 30ft wide, which is served by a 5 ton underslung gantry crane. The boiler house contains 14 bays of steelwork at the same centres as the turbine hall, the bay at the south end accommodating the various service water tanks. The operating floor is at a single level of 30ft above the basement, the turbine hall roof being 86ft and the boiler house roof 129ft above the basement floor. The coal bunkers are at the rear of the boilers on the side remote from the turbine hall.

To the rear of the boiler house are the reinforced concrete electrostatic precipitator casings, the ash handling plant and the dust reservoirs. The flues from the precipitators are connected to two 330ft high reinforced concrete chimneys, each of which has an internal diameter of 21ft at the top. The chimneys and other sections of the reinforced concrete work which form salient features of the general architectural aspect have been constructed in coloured cement to blend with the brickwork of the main station buildings. At the south end and adjoining the main building is the administrative block, which accommodates the laboratory, workshops, water treatment plant, locker rooms and the canteen.



Site plan of Tilbury generating station

The whole administrative block has been designed and constructed so as to provide adequate facilities for the running of any future extension to the generating capacity of the site.

Although there is good road and rail access to the site the station has been designed to use seaborne coal, and a 700ft long jetty has been provided to accommodate ocean-going colliers. Provision has been made for extending this jetty downstream when the "B" station is built. Coal is unloaded from colliers by means of four Stothert & Pitt 200 tons/hr capacity, 7½ ton grabbing cranes on the jetty. Each crane is equipped with a hopper and transfer belt incorporating a Blake Denison continuous belt weighing apparatus of 200 tons/hr capacity. Coal is then conveyed by a conventional system of belts either to the 270ft wide coal store or to the six 930 tons capacity boiler bunkers. The coal is deposited into the store by means of a travelling tripper tower on the conveyor running along the western side of the storage area. It is reclaimed by means of a travelling telpher on a transporter bridge spanning the coal store. Automatic coal sampling equipment is incorporated and continuous belt weighing apparatus is installed on the belts feeding the boiler bunkers.

Work is proceeding on the installation of fuel oil storage and handling equipment to enable the station to consume oil as an alternative to coal. The oil will be delivered by tankers to the jetty and pumped into two 120ft diameter storage tanks adjacent to the south end of the coal store. Auxiliary boilers are being installed to provide the heat necessary to maintain the oil in a fluid state, together with pumps and heaters to ensure that it reaches the boiler burners at the requisite pressure and temperature. Tracing of the oil lines will be by means of hot water at 250 lb/sq in.

In the case of coal firing the coal is pulverised in Thompson-Kennedy tube type ball mills, two for each boiler, coal being fed into the mill by means of a plough disc type feeder driven by an independent two-speed motor with an automatic feeder controller to maintain the correct level. Each mill has a capacity of 17 tons/hr and is driven by an English Electric 515 b.h.p., 575 r.p.m., 3·3 kV, squirrel cage induction motor. Pulverised fuel is withdrawn from each mill by means of three exhauster fans driven by English Electric 61 h.p. d.c. motors with automatic speed variation from 1,470 to 720 r.p.m. The supply for these motors is obtained from 490 kW steel tank mercury-arc rectifiers of English Electric manufacture and speed control is achieved by a pneumatically operated variable field rheostat. The two mills together feed twelve 12in Thompson-Kennedy rotary impeller burners in the rear wall of each boiler, and these are fitted with adjustable secondary air registers and fuel and primary air adjustments.

When the station is using coal for fuel the coarse ash is collected in water-filled hoppers beneath the boilers. The ash is discharged at intervals into a sluiceway along which it is conveyed by means of high-pressure water jets into the ash sump at the rear of the boiler house. The coarse ash is recovered by a travelling grabbing crane and deposited on to a draining apron, the drained ash then being loaded into lorries for disposal. The water flowing into the sump during ashing passes through a screen and is returned to a reservoir for recirculation by the h.p. sluicing pumps. The boilers are each equipped with twelve precipitator dust hoppers from which the dust is ejected by windswept valves. In addition, four dust hoppers are provided beneath the mechanical grit arrestors, which are placed in the main flue before the electrostatic precipitators. From these points the dust is carried to one of the eight 90 ton bunkers behind the precipitators from whence it is deposited into lorries via a water-mixing scroll-type conveyor. Both the ash and the dust are carried to a disposal area at the north end of the site.

Four 2,200 gal/min high-pressure water pumps, driven by 350 b.h.p., 730 r.p.m., 3·3 kV Metropolitan-Vickers

motors, are provided for sluicing the ash to the sumps and operating the dust ejectors. There are two 2,100 gal/min pumps, driven by 80 b.h.p., 3·3 kV motors, situated alongside the ash sumps and these are used to return the decanted water to the reservoir.

Steam Raising Plant

The completed station will accommodate six "Etaflo" two-drum boilers supplied by John Thompson Water Tube Boilers, Ltd. Each has a maximum continuous evaporative capacity of 540,000 lb/hr, the pressure and temperature of the steam at the superheater outlet being 950 lb/sq in and 925 deg F, with a final feed temperature of 385 deg F. The combustion chamber is completely water cooled by 3in o.d. bare tubes pitched at 3¼in, the furnace dimensions being 78ft high with a cross-section of 31ft by 20ft. The effective surface of the furnace water cooling tubes exposed to radiant heat is 26,600 sq ft. The boiler is suspended from the main building steelwork and the entire furnace is free to expand vertically downwards and is sealed at the base by dipper plates immersed in a water-filled trough. A water walled pass at the rear of the boiler contains a three-stage superheater and a double-banked economiser. The superheated steam temperature control is achieved by the provision of automatic dampers which allow a portion of the gas to by-pass the superheater and the main section of the economiser. Provision is also made for the recirculation of inert gas to quench the superheater elements during pressure raising.

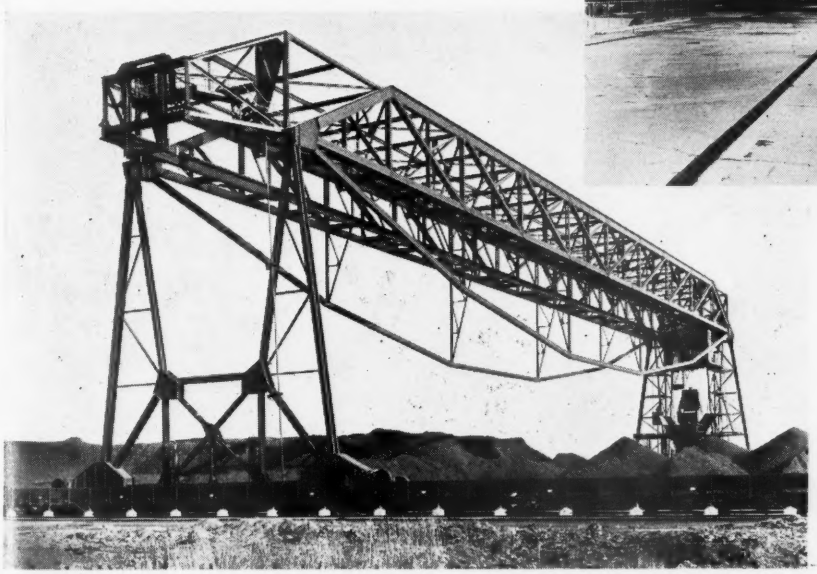
The three-stage superheater is of the horizontal self-draining type with an effective heating surface of 19,050 sq ft and the tubes are supported by steam-cooled downcomers. The economiser has a total heating surface of 18,340 sq ft and is of the plain tube type situated below the superheater. Each boiler is provided with two Howden-Ljungstrom rotary type air heaters having a total surface of 234,000 sq ft. The dust extraction equipment consists of two banks of multi-cellular units of the cyclonic type, together with twin Sturtevant electrostatic precipitators of the standard tubular type fed with high voltage from mechanical rectifier equipment.

Each boiler drum has a local direct-mounted water gauge, together with a "Yarway" remote level indicator situated at operating floor level. There is also a Hopkinsons television equipment and this is fitted to the main boiler control board in the unit control room. An automatic boiler control system has been fitted by the Electroflo Meters Co. Provision is made for hand control of the automatic regulation and also for remote manual operation of all control dampers. Isolating dampers are operated by English Electric actuators. Feed water control is achieved by the Copes "Flowmatic" system, which is responsive to both boiler water level and steam flow.

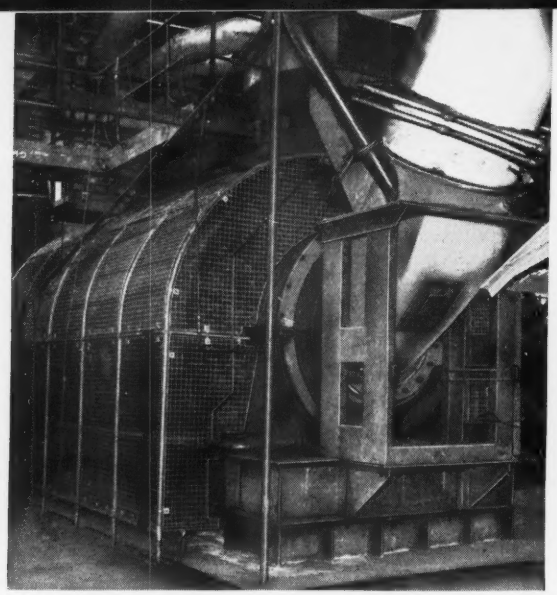
In order to produce steam conditions suitable for the turbines after overnight shut-downs six diesel-oil-fired combustors have been fitted above the superheaters to give a superheat boost on starting. Steam dumping arrangements have also been provided by installing a flash box across the main turbine condenser where the steam is desuperheated by means of condensate recirculation via the extraction pumps.

Fifteen electrically operated Hopkinsons soot blowing units are controlled automatically in sequence from a panel situated on the operating floor. The furnace soot blowers comprise four single-nozzle retractable blowers in the furnace roof and superheater blowers include four

Above: Ocean-going colliers are unloaded from a 700ft jetty



Left: Coal is reclaimed from storage by means of a travelling telpher on a transporter bridge spanning the coal store



Two Thompson-Kennedy tube type ball mills serve each boiler

Part of No. 1 unit control panel

single-nozzle retractable blowers and seven mass element rotary type units. The steam for soot blowing is taken from the superheater inlet header.

There are four Dewrance consolidated "Maxiflow" safety valves on the steam drum and three on the superheater outlet header, one of which is electrically assisted. There is a Hopkinsons high-low alarm fitted to the water drum.

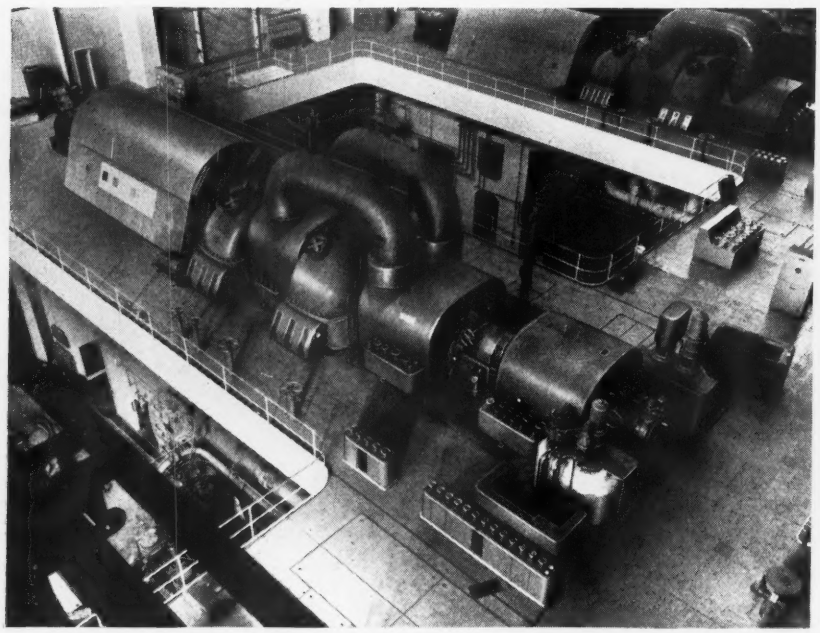
There are twelve rotary impeller p.f. coal burners situated in the rear wall of the furnace and two oil burners in each of the side walls. Each boiler is equipped with two f.d. and two i.d. fans supplied by Davidson & Co., Ltd. The f.d. fans are driven by English Electric 234 b.h.p., 730 r.p.m., 3·3 kV squirrel cage motors, while the i.d. fans are driven by 456 b.h.p. motors of the same type and make. Speed control of the i.d. fans is by means of a hydraulic coupling. The f.d. fans are situated at drum level, while the i.d. fans are at ground level between the precipitators and the main flue.

The station is arranged for unit operation and the main control panel for each unit, supplied by the Electroflo Meters Co., contains the instruments for both boiler and turbine control which have been incorporated in a mimic diagram. These control panels are accommodated in pairs in unit control rooms which are situated between the boilers and turbines on the operating floor of the station.

The automatic control of the boilers is achieved by sensing variations in the main steam conditions. An Electroflo superheat temperature control regulates the temperature by the operation of by-pass dampers and the pressure variation is sensed by a master regulator which, by the biasing of air pressure, operates power cylinders attached to the various regulating dampers and speed controls associated with the f.d., i.d. and fuel systems.

The station is a little unusual in that the first three turbo-alternator sets are of English Electric manufacture, the other three having been supplied by C. A. Parsons & Co., Ltd. All six machines run at 3,000 r.p.m. and have a maximum continuous rating of 60 MW when the steam conditions at the stop valve are 900 lb/sq in and 900 deg F and a final feed temperature of 385 deg F. They are all three-cylinder machines with five stages of bled steam feed heating.

Full duty a.c. motor driven auxiliary oil pumps are provided to start automatically in the event of oil failure and an a.c. motor driven flushing oil pump and jacking oil pump are used in conjunction with the barring gear. Three 50 per cent capacity oil coolers are installed for each set using circulating water as the cooling medium. The governing



No. 1 turbo-alternator unit

gear in each case is of the centrifugal type, controlling the throttle valves by means of high-pressure oil through relay valves. Overspeed protection is provided by eccentric rings, which operate if the speed should rise above a predetermined level. Load is automatically rejected by the machines in the event of a loss of vacuum or undue loss of steam pressure. Supervisory equipment is also provided to enable the operators to observe the expansion and eccentricity of the h.p. rotors when the machines are run up.

The English Electric turbines are primarily impulse machines with 17 stages in the h.p. cylinder, 14 stages in the i.p. cylinder, and a single stage followed by seven reaction stages in each half of the divided flow l.p. cylinder. The specified steam and heat consumptions at 60 MW are 8·361 lb/kWh and 9,186 B.Th.U/kWh respectively, with an absolute back pressure of 1·2in Hg.

Each machine exhausts into a twin condenser of the surface type, having two passes on the water side, a total cooling surface of 57,000 sq ft, and a normal cooling water requirement of 38,000 gal/min. The condenser is arranged so that one half may be isolated for cleaning on the water side while the turbine is being run at reduced load.

There are two Weir three-stage air ejectors and one quick-start air ejector for each turbine. The three-stage units are condensate cooled and each operates at a steam pressure of 200 lb/sq in and 1,550 lb/hr, while the quick-start ejector is supplied with steam from the auxiliary steam manifold at 400 lb/sq in.

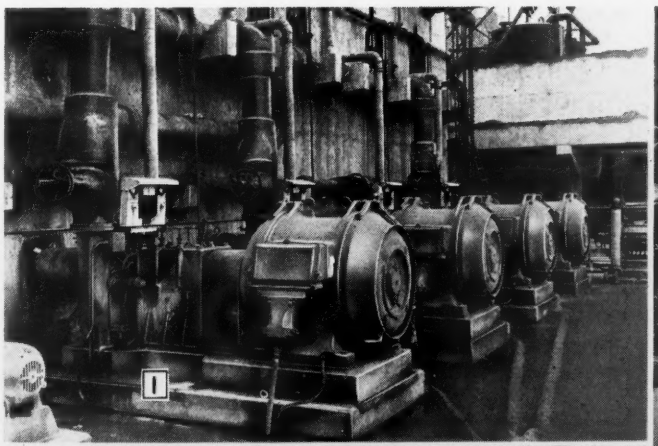
The two 100 per cent duty two-stage vertical-spindle extraction pumps are driven by 70 b.h.p., 1,450 r.p.m., a.c. motors and 725 gal/min of condensate is passed by each pump when working against a head of 127ft. The feed heating train consists of four English Electric surface heaters and one direct contact de-aerator heater of Hick, Hargreaves manufacture. Condensate is pumped from the condenser at 81·8 deg F by either extraction pump and is fed through one air ejector, drain cooler and l.p. heater to the de-aerator heater. From here it passes through a feed pump to the three h.p. heaters and then to the boilers. The drains are cascaded back and pass through the drains cooler before entering the condenser. Make-up is introduced into the system through the reserve feed tank. There are three 50 per cent duty electrically driven feed pumps for each boiler, one acting as standby and two as worker pumps. Supplied by Sulzer Bros. (London), Ltd., they have eleven stages with a horizontal spindle directly coupled to a 700 b.h.p., 2,980 r.p.m., 3·3 kV Metropolitan-Vickers induction motor.

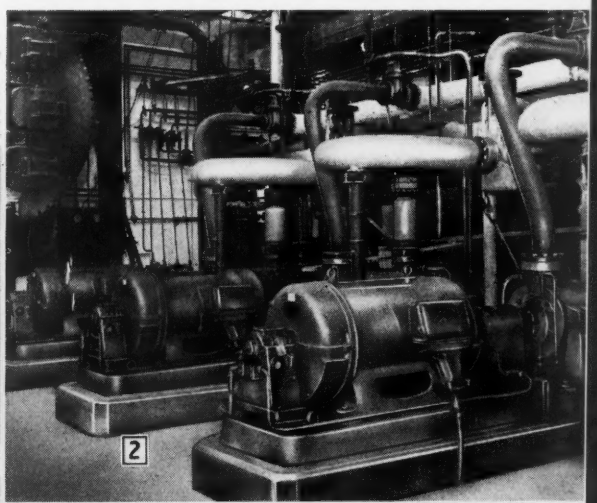
Parsons Turbo-Alternators

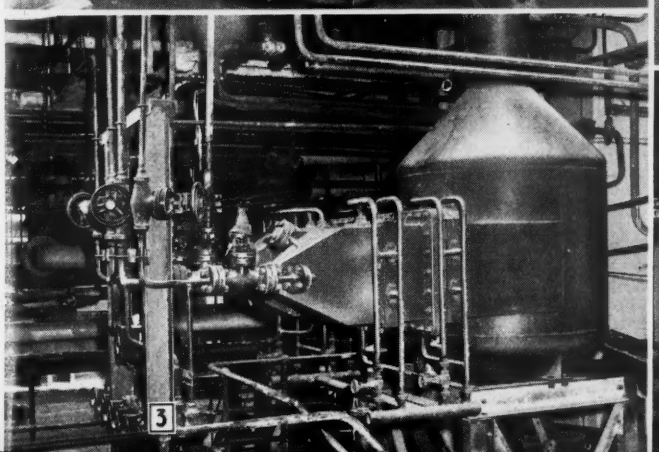
In the case of the Parsons machines the general specification is similar to that for the English Electric sets described above. The turbines are of the reaction type, however, having 19 h.p. stages, 19 i.p. stages, and six stages in each half of the divided flow l.p. cylinder. The specified steam and heat consumptions at 60 MW are 8·394 lb/kWh and 9,217 B.Th.U/kWh respectively, with an absolute back pressure of 1·1in Hg. The condensers on these machines consist of one shell containing two separate c.w. circuits, the total cooling surface and c.w. requirement being the same as for the English Electric machines.

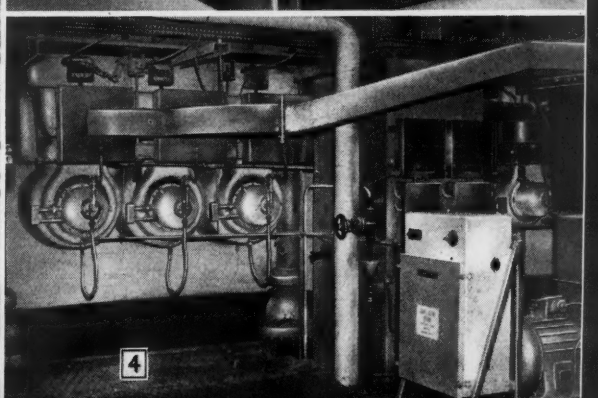
There are two Parsons three-stage air ejectors and a quick-start ejector for each turbine. The main ejectors

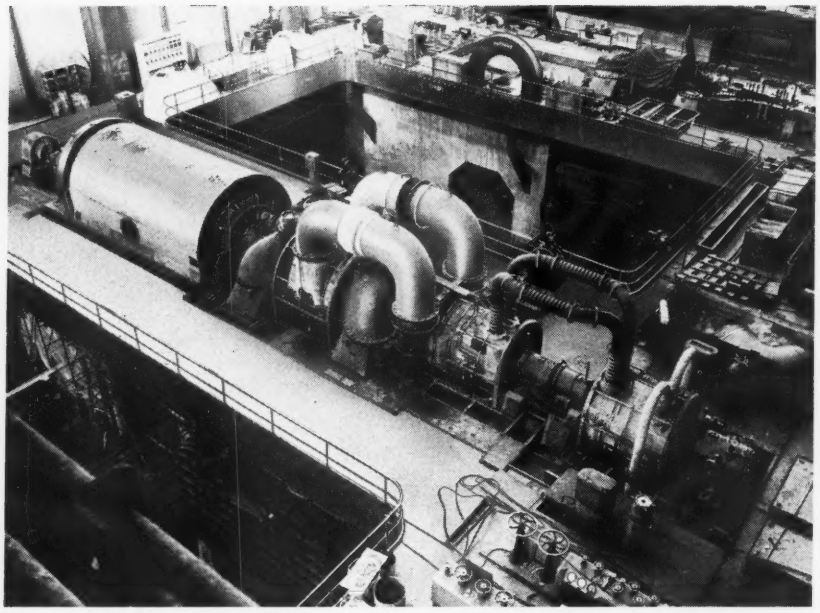
1. Four 2,200 gal/min pumps provide high pressure water for ash sluicing. 2. Three 50 per cent duty feed pumps serve each boiler. 3. A flashbox is connected across the main turbine condenser for steam dumping purposes. 4. Six oil-fired combustors are fitted above the superheaters to give a superheat boost on starting











One of the three 60 MW Parsons sets under construction

are condensate cooled and each consumes 1,675 lb/hr, while the quick-start ejector is fed from the auxiliary steam manifold and consumes steam at the rate of 6,500 lb/hr. Either of the two 1,000 r.p.m. extraction pumps is capable of dealing with the condensate and each is driven by a 92 b.h.p. L.D.C. induction motor. Provision is made for bled steam feed heating by two l.p. heaters and two h.p. heaters of Parsons manufacture, together with a Worthington-Simpson high-level de-aerating hot well. Condensate is pumped from the condenser at a maximum rate of 750 gal/min against a head of 200ft, and passes through the ejector, drain cooler, and two l.p. surface heaters. From there it rises to the high-level de-aerator heater and hot well, which has a capacity of 13,000 gal. It is then dropped to the feed pump suctions and passes through two h.p. surface heaters before entering the boiler. The drains from the surface heaters are cascaded back via the drains cooler to the condenser. The boiler feed pumps are identical to those used in conjunction with the English Electric sets.

The first two machines in the station are equipped with dual-purpose triple-effect evaporating plant manufactured by Aiton & Co., Ltd. These are fed with town water which has been treated in a Permutit hydrogen-ion-sodium blend water softener and each is capable of an output of 21,000 lb/hr. On each of the remaining four sets Aitons have supplied two double-effect low-pressure salt water evaporators. Each of these has an output of 10,500 lb/hr and the distillate produced is passed through a Permutit "Deminrolit" plant before entering the system. This plant is so arranged that it can handle town water direct, if required.

The circulating water pump house contains six Drysdale vertical-spindle pumps, each with a capacity of 42,000 gal/min against a head of 42ft. They are driven at 485 r.p.m. by 700 b.h.p. 3·3 kV Laurence Scott motors. Water for the pumps is taken from the Thames through a vertical inlet shaft situated under the coaling jetty and a 11ft 8in diameter tunnel to the circulating water screens and pumps on the shore side of the river wall. The circulating water is then discharged through reinforced concrete culverts to the condensers and from there returned to the river via a tunnel and shaft some 1,000ft upstream from the inlet. The c.w. screens are of the rotating band type supplied by William E. Farrer, Ltd. Chlorination of the c.w. is carried out either manually or automatically by an installation supplied by United Filters, Ltd.

Both the English Electric and Parsons 3,000 r.p.m. 75 MVA alternators generate at 11·8 kV and are solidly connected to 11·8/132 kV, 72 MVA generator step-up transformers situated in a cellular annexe along the west wall of the turbine house. Excitation in each case is provided by gear driven main and pilot exciters running at 1,000 r.p.m. and voltage regulation is effected by Metropolitan-Vickers equipment of the vibrating reed type. All machines except the fifth one are arranged for hydrogen cooling in the conventional manner, the gas pressure being 0·5 lb/sq in. The normal quantity of hydrogen being delivered from the coolers is 60,000 cu ft/min and the drop in pressure through the alternator varies from 1·1 to 1·6in water gauge. The fifth machine (Parsons) retains hydrogen cooling for the rotor, but the stator windings will be constructed of hollow rectangular section conductors and will be cooled by passing demineralised water through and in direct electrical contact with the conductors. This water will be circulated through a closed system and cooled by heat exchangers using distilled water as the cooling medium.

All switching is effected at 132 kV in the grid substation to the north of the main buildings. The 11·8/3·3 kV, 6 MVA unit transformer for each set is connected to the generator tails of each machine. Two 10 MVA station transformers are also provided to obtain

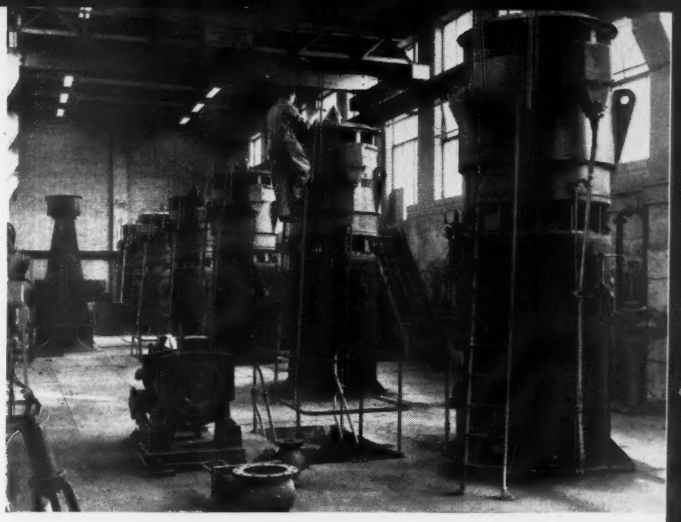
General view of the main electrical control room

works power from the grid network. Under normal running conditions the unit transformers supply their associated 3·3 kV board. The unit boards can be supplied alternatively from station boards which are fed through the station transformers from the 132 kV busboard. The 3·3 kV boards feed the larger station motors and various 415 V boards through step-down transformers.

The generator and station transformers are of English Electric manufacture, while the auxiliary transformers were supplied by the Brush Electrical Engineering Co., Ltd.

The auxiliary switchgear within the station is of the English Electric air-break pattern, with a rupturing capacity of 150 MVA in the case of the 3·3 kV gear and 15 MVA in the case of the 415 V equipment. The 132 kV outdoor switchgear is of the Metropolitan-Vickers air-blast type and has a rupturing capacity of 3,500 MVA. The station output is at present disposed of via a pair of 275 kV lines to Elstree working at 132 kV. Future extensions from the grid substation include lines to Rayleigh and Barking. A supply is also available to the Eastern Electricity Board via a 33 kV substation situated in the north-west corner of the site. It is intended that a 275 kV substation will be erected at the north end of the site to cater for future extension in the area.

The main electrical control room is situated in the centre of the administration building at the south end of the turbine house. It contains the controls for the generators, 132 kV switchgear, and main power station circuits. There are also controls for the 33 kV substation which is fed from the 132 kV switchgear through step-down transformers. Provision has been made for the installation of control panels associated with the future 275 kV switchgear. Protective relay panels, metering and telecommunication equipment are housed in anterooms off the main control room.



The c.w. pump house accommodates six 42,000 gal/min vertical spindle pumps

The consulting engineers are Merz & McLellan, for whom Sir Alexander Gibb & Partners act in respect of civil engineering works. The main contractors are: civil engineering works, Holloway Bros. (London), Ltd.; superstructure, Walter Lawrence & Sons, Ltd.; steelworks, Alexander Findlay & Co., Ltd.; boilers, John Thompson Water Tube Boilers, Ltd.; coal handling plant, Mitchell Engineering, Ltd.; ash plant, Babcock & Wilcox, Ltd.; turbo-alternators, condensing and feed heating plant, English Electric Co., Ltd., and C. A. Parsons & Co., Ltd.; 132 kV cables, Pirelli-General Cable Works, Ltd.; cables up to 11 kV, Britannic Cables, Ltd.; 132 kV switchgear, Metropolitan-Vickers Electrical Co., Ltd.

Acknowledgment is due to Mr. W. N. C. Clinch, Controller, Eastern Division, Central Electricity Authority, for permission to publish this article.

New Books

Circuit Theory and Design. By J. L. Stewart. Pp. 480; figs. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 76s.

This book is designed as an introduction to modern methods of network analysis and synthesis, using the pole-zero concept. This powerful tool has for some considerable time been used in advanced work but suitable textbooks for undergraduates are lacking. Mr. Stewart sets out to fill this gap, without the use of Laplace or Fourier transform methods. Instead, he bases his work on the concept of the "phasor," that is, a vector in the complex frequency plane, which joins any pole or zero of the function to the point under discussion. Gain and phase functions may then be rapidly evaluated by graphical methods.

An introductory chapter deals with circuit analysis, both mesh and node techniques being utilised. The poles and zeros of functions and of functions representing networks are then covered. The next four chapters deal with network synthesis and circuit behaviour. The rest of the book is devoted to active networks, i.e. valves, low-pass, band-pass and feedback amplifiers, oscillators and servo-mechanisms.

The general impression made by the book is most favourable and even at a cursory glance it looks vastly more interesting than more conventional treatments, an opinion well borne out by a careful reading. Personally, I feel it a pity that the author decided to limit himself rather severely on the mathematical techniques. This makes Chapter II somewhat inconclusive and I could not solve the problems on this chapter without using more powerful tools than are given to the reader. However, many users may feel the exact reverse.

Another criticism of Chapter II is that the positive sense of angles, anticlockwise as usual, should be explicitly stated and kept to. Fig. 2.4 is misleading because this has not been done.

The book can be thoroughly recommended especially in this country, where instruction in circuit theory tends to be lamentably out of date.—A.H.W.B.

BOOKS RECEIVED

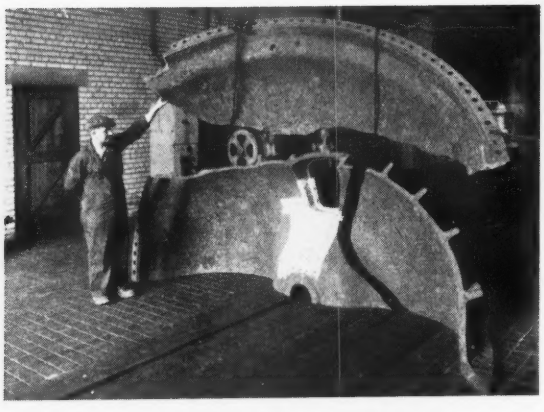
Electric Wiring (Domestic). 6th Edition. Edited by E. Molloy. Pp. 268; figs. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 10s 6d.

Voltage Stabilised Supplies—Basic Principles, Characteristics and Applications. By F. A. Benson, M.Eng., Ph.D., A.M.I.E.E., M.I.R.E. Pp. 370; figs. MacDonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 50s.

Switchgear Principles. By P. H. G. Crane, M.Sc., A.M.I.E.E. Pp. 238; figs. Cleaver-Hume Press, Ltd., 31, Wright's Lane, Kensington, London, W.8. Price 25s.

An Interesting Repair

FROM A CORRESPONDENT



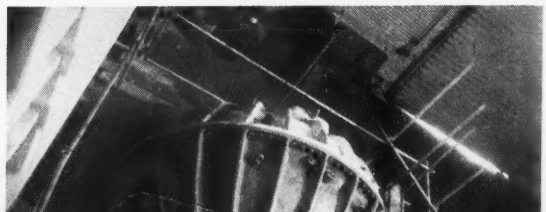
This picture shows the extent of the damage to the casing. The roughness of the faces was removed to ensure that no stresses would be set up when clamping the broken pieces into position

THE casing of a rotary strainer at the Bromborough power station of the North West, Merseyside and North Wales Division of the Central Electricity Authority, which had sustained considerable damage through a fracture, was recently successfully repaired within a period of seven weeks, using the Metalock (Britain), Ltd., system of cold repair. The following notes outline the problems involved and deal with the repair methods employed.

Bromborough power station is situated on the banks of the River Mersey and has an installed generating capacity of 210 MW, the plant comprising eight Babcock & Wilcox boilers, each of 300,000 lb/hr capacity, and four English Electric turbo-alternators, each of 52·5 MW rating. Condenser cooling water is drawn from and discharged into the River Mersey through an installation of five vertical circulating pumps supplied by Drysdale & Co., each with a maximum capacity of 39,140 gal/min at high tide and 28,840 gal/min at extreme low tide. On the discharge side of each pump is a 54in bore rotary strainer, manufactured by Hick, Hargreaves & Co., and incorporating a 10ft 6in diameter straining wheel contained in a spherical cast-iron casing weighing 12½ tons.

It was the casing of No. 1 strainer which recently sustained considerable damage, in the nature of a "compound" fracture of the top half. The casing is built in quarters, the four quarters being bolted together through flanges, and the top inlet quarter was fractured through the flange of the access door, extending for twenty inches directly towards the strainer wheel shaft gland stuffing box. The top outlet quarter was also badly fractured, and when dismantled was in three separate pieces. The total length of fracture was 29ft.

As the pumping station is situated in a separate building on the river bank, the complete casing was first removed to the turbine house loading bay, for ease of handling and also to provide access to a continuous supply of compressed air, which is the motive power for the tools used by Metalock operators.



The complete casing weighed 12½ tons and the several fractured parts were clamped together before "Metalocking"

To avoid distortion during repair the unbroken portion of the casing was first placed on the floor of the loading bay and to facilitate complete access to all the parts a scaffolding was placed around this unbroken half and staging erected. The main horizontal and circumferential joint bases of both top quarters were then thoroughly cleaned of joint compound in order to make metal-to-metal joints during subsequent assembly. It was appreciated that perfect fitting of the broken parts would be difficult, if not impossible, and it was found necessary to remove the roughness of the fractured faces, thus relieving them and ensuring that no stresses would be set up during the process of clamping.

The next (and the most difficult) step was to bolt the top inlet quarter to the bottom half. No special bolts were necessary as it was possible to place all the original bolts in their respective holes and then harden up. The outlet top quarter pieces were then assembled and again all bolts were placed in position; preparatory work was undertaken by the power station staff and the job was then handed over to the Metalock operators.

Using a jig for correct spacing and alignment, 348 rows of blind pilot holes were drilled across the fracture. The holes were then opened out and a narrow channel cut between adjacent (and thus interconnected) holes, looking something like a succession of alternate O's and hyphens. Into the spaces thus created were driven Metalock keys of the same cross-section, a calculated number of keys being driven into each aperture and peened with pneumatic hammers, so that the pieces of parent metal were held firmly together. Altogether 1,392 keys were used in this operation.

The keys are of a highly ductile, heat-resisting alloy of great tensile strength, with an expansion coefficient similar to that of the casting. Added strength was given to the repair by resort to "Metalacing." This consisted of drilling and tapping holes along the line of fracture, into which studs were inserted and subsequently peened.

In this repair there were 348 "stitches" inserted across the fracture, 2,436 holes drilled for locking and lacing, and the total depth of holes drilled was 319ft. A total depth of 87ft was drilled for the lacing operation, and all of these holes were tapped by hand.

To carry out the finishing repair to the top outlet quarter it was found necessary to remove it, and in the course of re-erection it was found that there were two irregular spots on circumferential joint spaces. Using stainless steel, these were repaired by metallising, and the faces were finished by grinding.

The Mercury Ohm

By L. G. A. SIMS, D.Sc., M.I.E.E.*

Historical Survey of the Standardisation of the Unit of Resistance

THE first British Standard of resistance (other than the irrational and unrelated haphazard standards which had been in use hitherto) was established in 1862-63, as a result of the work of members of a British Association Committee formed in 1861. This standard or "practical unit" was wire-wound and a number of them were made using wires of different materials and some of these still exist, mainly at the National Physical Laboratory. They purported to represent 10^9 c.g.s. electromagnetic theoretical units of resistance. In the c.g.s. electromagnetic system of units resistance has the dimensions of a velocity and the magnitude of the theoretical unit expressed as a velocity is "the earth quadrant (passing through Paris) per second."

The standards or "practical units" (as distinct from the defined or theoretical unit) were called "B.A. Units" and they were "realised" by absolute means. The means was Kelvin's spinning earth inductor, with Wheatstone's bridge used to enable the B.A. units to be reproduced from the resistance of the Kelvin spinning inductor.

Between 1870 and 1881 the B.A. units were accepted throughout the world. But by 1883, Lord Rayleigh had shown that they differed from the theoretical unit and a great deal of the original experimental B.A. committee work was repeated by Lord Rayleigh and associates at the Cavendish Laboratory, Cambridge, again using the spinning coil method. It can be seen in retrospect that very accurate realisations of the unit were then achieved, in the 1880's, even though the next 70 years have seen still more precise absolute determinations.

International Action

But by 1875 the matter of resistance standards had come under international review and the first International Electrical Congress was held in 1881. That conference recommended that the unit of resistance be represented practically by a column of mercury 1 sq mm in cross-section, at the temperature of 0 deg C and of a length to be determined by an International Commission, on the basis of absolute measurements. At conferences held in 1882 and 1884, the length was fixed at 106 cm.

Formal international action was taken by the Chicago Congress of 1893, which adopted the following definitions:

"Resolved, that the several Governments represented by the delegates of this International Congress of Electricians be, and they are hereby, recommended to adopt as legal units of electrical measure the following:

"As a unit of resistance, the international ohm, which is based upon the ohm, equal to 10^9 units of resistance of the c.g.s. system of electromagnetic units, and is represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice, 14·4521 gm in mass, of a constant cross-sectional area and the length of 106·3 cm.

"As a unit of current, the international ampere, which is one-tenth of the unit of current of the c.g.s. system of electromagnetic units, and which is represented sufficiently well for practical use by the unvarying current which, when passed through a solution of nitrate of silver, and in accordance with the accompanying specifications, deposits silver at the rate of 0·001118 gm/sec.

"As a unit of electromotive force, the international volt, which is the electromotive force that, steadily applied to a conductor whose resistance is 1 international ohm, will produce a current of 1 international ampere, and which is represented sufficiently well for practical use by 1,000/1,434 of the electromotive force between the poles or electrodes of the voltaic cell known as the Clark cell, at a temperature of 15 deg C, and prepared in the manner described in the accompanying specifications."

In 1908 a further International Conference on Electrical Units and Standards was held in London at the invitation of the British Government. This conference recommended that interested governments should establish a permanent International Electrotechnical Commission and suggested that the organisation might be linked with the General Conference of Weights and Measures.

The mercury column resistor had been due originally to Dr. Werner von Siemens who had used it in Germany. (His reasons have been re-adduced by recent correspondents in the *Electrical Review*.) However, the "Siemens Enheit" was originally made arbitrarily of 1 metre length (instead of 106 cm and 106·3 cm as fixed at later dates) but at 1 metre length it happened to approximate quite closely to 10^9 of the theoretical c.g.s. resistance units. For that reason it appealed to members of the International Conferences.

Reverting to the question of material as used in the "B.A. units," adjusted in value against the resistance of the Kelvin spinning coil, it is known that Professor Williamson and Dr. Matthiesen on behalf of the British Association Committee, had studied the behaviour of pure metals in the solid state and had reported against them. On mercury as a pure metal, however, they reported favourably but considered that the glass tubes, also amalgamation of the mercury with the electrodes, were unfortunate. Their final opinion was in support of *either* pure mercury *or* of a gold-silver alloy. Lord Kelvin, then Sir William Thomson, had earlier used German silver resistance coils. The report upon this work on materials was made at the 1882 British Association meeting in Southampton.

In the days of Gauss, Weber and Kelvin, the solid material favoured for a resistance standard was "German Silver," an alloy consisting of about 60 per cent copper, 26 per cent zinc, and 14 per cent nickel. During the British Association experiments, the gold-silver alloys recommended by Professor Williamson and Dr. Matthiesen contained about 60 per cent gold, 20 per cent silver, 20 per cent copper. But the test of years has shown that of the various "B.A. units" those employing pure platinum have changed least with time.

London Conference Decision

The London Conference of 1908 adopted the absolute system of units as the "fundamental units" but also adopted a specified form of the arbitrary Siemen mercury column standard as the practical standard representing the fundamental unit of resistance. This "International Ohm" remained in use until 1948. By that date, absolute methods of measurement of resistance had become more

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reliable and easier to operate than the international mercury ohm and it has been increasingly certain (since about 1933) that a small discrepancy in magnitude existed between the value of the international ohm and the absolute value.

The theoretical ohm can now be realised by absolute methods of measurement more readily than the mercury standard can be set up and the greatest possible error is known to lie within 12 parts per million. It is reasonable to say that man can now reproduce the theoretical unit to 1 part in 100,000 with certainty. In this country, at the National Physical Laboratory, the measurement has been made by means of the Lorenz machine using direct current (Vigoureux and Hartshorn) and by the method of Albert Campbell using alternating current (Hartshorn and Astbury). Contemporary results obtained in the U.S.A. (Curtis, Moon and Sparks) and in Germany (Grüneisen and Giebe), all show that the international ohm was high in value by about 50 parts in 100,000 (and the international ampere low by about 15 parts in 100,000). The international ohm could have been adjusted readily by a proportionate change in length of the mercury column, but this was not considered worth while. Thus ended the international mercury ohm, the last of the arbitrary resistance standards.

The material now used in resistance standards is invariably Manganin, an alloy first developed by Dr. Weston, then by workers at the P.T.R., Berlin, developed again during the first world war in this country (the art being then temporarily lost) and finally developed here once more to a fine art during the second world war.

Manganin shows not only great constancy with time but an exceedingly small temperature coefficient over certain limited ranges of temperature. Its exact composition is a metallurgical secret, but it is approximately 85 per cent copper, 12 per cent manganese, 3 per cent nickel. In some formulæ, up to 1 per cent iron has been included, in others iron is rigidly excluded. Its low-temperature coefficient has been stated to be almost a function of its iron content.

In the best samples of Manganin the temperature coefficient of resistance is only about 2 parts per million per degree over the working temperature range and its thermal e.m.f. against copper about 1 part per million, that is 1 microvolt per degree. Its very long time stability is of the order of 10 parts per million, which corresponds closely with the present uncertainty in the exact value of the standard, as determined by absolute means.

In conclusion, it should be stated that, as a result of the abandonment of the international ohm and the international ampere in 1948, any laboratory standard marked 1 international ohm is now to be regarded as 49 parts in 100,000 smaller than 1 ohm. This change does not affect the unit which remains the theoretical concept as defined by Clerk-Maxwell in terms of velocity.

Acknowledgment is made to authors of the following main sources of reference:—

(1) " Units and Standards of Electrical Measurement," Hartshorn. J.I.E.E., Vol. 99, Pt. I.

(2) " The Accuracy of Measurement of Electrical Standards," Felton. J.I.E.E. (Proceedings, Pt. II), December, 1951.

(3) " A Discussion on Units and Standards." Communication from N.P.L. Reprinted from Proc. Royal Soc., 1946.

(4) " The Absolute Measurement of Resistance," Hartshorn and Astbury. Proc. Royal Soc., 1937.

(5) " Units and Standards of Measurement, III. Electricity." D.S.I.R.

(6) Proceedings of the Cambridge Physical Society (1937).

(7) Dictionary of Applied Physics, Vol. II. Glazebrook and Smith.

(8) B.A. Reports. Cambridge Press, 1913.

(9) " Establishment and Maintenance of the Electrical Units," Silsbee. N.B.S. Circular 475.

(10) " Life of Lord Kelvin," Silvanus Thompson.

(11) " The Principles Involved in the Selection and Definition of the Fundamental Electrical Units to be Proposed for International Adoption," F. A. Wolff. Bureau of Standards Reprint No. 102, 1908.

American I.E.E. Policy Change

ACCORDING to the *Electrical World*, the American Institute of Electrical Engineers is to limit its activities to the " advancement in technology in all branches of electrical engineering," and activities in the field of professional development and economic status are delegated to the National Society of Professional Engineers.

Several other important policy changes have been announced. It is proposed that the Engineers' Joint Council should provide the medium for co-ordination and co-operation on technical matters transcending the electrical field, and present to the public the position of the engineering profession on technical matters; the Engineers' Council for Professional Development should provide the medium for guidance in engineering education; and the National Society of Professional Engineers should provide the medium for the general promotion of the professional aspects of engineering in the eyes of the public and be instrumental in the consequent enhancement of the economic status of engineers.

The journal comments that the assignment to the National Society of Professional Engineers is perhaps the most significant of the proposals. In effect, the A.I.E.E. Board has said that the Institute, an organisation with 50,000 members, should turn over a major responsibility to the N.S.P.E., with which only a minority of A.I.E.E. members are affiliated or meet membership qualifications by registration. In order to overcome this disproportionate representation the Board recommends to A.I.E.E. members that they register as professional engineers. It is further proposed that the N.S.P.E. should put itself in a position to represent the profession more completely by expanding its individual membership organisation to include those qualified members of the profession whose work does not by law require registration as well as registered engineers.

Engineering Education

THE London and Home Counties Regional Advisory Council for Higher Technological Education has just published No. 8 (sixth edition) of " Engineering Education in the Region."

It contains lists of colleges holding courses of engineering education and was compiled from returns for the 1956-57 session. As a general indication of the distribution of courses it will also hold good for 1957-58. Detailed information, however, should be obtained from the principal of the college concerned.

The booklet, which costs 2s 6d, may be obtained from the secretary, Regional Advisory Council for Higher Technological Education, Tavistock House South, Tavistock Square, London, W.C.1.

VIEWS on the NEWS

By REFLECTOR

ONE of the complaints reported to the South Eastern Electricity Consultative Council last week concerned a consumer in Sussex who is paying, by instalments, a sum of £200 or so towards the cost of providing an overhead line to supply his premises. Since the agreement was made with the Board another house has been built nearby and, being within the prescribed distance from the mains, the owner had a legal right to demand a supply, without paying towards the cost of the line. The Board had intimated to the original consumer that it would, on request, unofficially approach any future applicants for a supply and explain the position. This it has done, but the newcomer has declined to make any contribution to the expense incurred by consumer No. 1 who, quite understandably I think, feels it unfair that he should have to pay the whole amount. This problem is not a new one and it is a pity that something cannot be done to arrive at a more equitable arrangement. Clearly it does not pay to be first in the field where an electricity supply is concerned.

* * *

Nuclear development is not confined to the big powers. I see, from a Press report, that an agreement has been drawn up between the Dominican Government and the Glenn L. Martin Co. for the provision of a nuclear power station near the capital, Ciudad Trujillo. This small republic in the West Indies has also been in negotiation with the United States regarding bilateral treaties for co-operation in the investigation and development of atomic energy for peaceful uses.

* * *

I quote the following from the *Electrical Power Engineer*, the official journal of the E.P.E.A.:—

> "We are pleased to announce that a former president of the Association, Councillor J. Parr-Morley, has been appointed a member of the North Thames Gas Consultative Council, but hope there will be no danger of him getting the wires (or the pipes) crossed."

But why was the paragraph headed "Shame!"?

* * *

A Scottish correspondent tells me that interest in the creation and operation of smokeless zones continues to grow and a number of projects are in progress. The first smokeless zone north of the Border came into being at Sighthill, Edinburgh, some four months ago, under the Edinburgh Corporation Order 1950, and the second phase of the Sighthill smoke control area may well be the first operation of its kind in Scotland under the new Clean Air Act. Kirkcaldy has two smokeless zones in prospect, one in the Links area where all-electric houses and gas coke fired houses will be combined, and at Templehall where a similar arrangement will apply. He says that present anticipation is that much of the burden of conversion to smokeless zone operation must be carried by the gas industry since it is more economic to convert an existing solid fuel unit burning normal fuel to a smokeless approved unit (taking subsidies into account) than to convert to all-electric operation on the scale possible in new construction. "The likely prospect is thus that older premises will be converted to the use of smokeless fuel while new construction will tend to be all-electric." In smokeless zones the use of special fuels is controlled by tenancy agreements but failing a supply of these I cannot imagine that the tenants will be expected to remain fire-less in winter. Nor am I convinced that conversion to all-electric operation need be ruled out on grounds of cost.

* * *

A reader of the *Birmingham Post* has drawn the journal's attention to the difference of the methods of approach to hesitant consumers by the West Midlands Gas Board and the Midlands Electricity Board. While the Gas Board asks the customer to be good enough to give the matter (i.e. the bill) his immediate attention, the Electricity Board threatens that unless the account is settled by a certain date the supply will be cut off. This is certainly less polite but I am quite sure that it is more effective.

* * *

Experiments in the application of electricity to horticulture go back many years. I came across an early example in the issue of the *Electrical Review* of 2nd August, 1907, just fifty years ago. This was an experimental culture installation at the Royal Botanic Gardens, then at Regent's Park, a description of which was given by Mr. B. H. Thwaite in a paper read before the Royal Botanic Society. The elaborate system employed comprised a suction gas producer and gas engine, a dynamo operating arc lamps and an electrostatic machine. The heat absorbed by the cooling water in the cylinder jacket was utilised for heating the air, and the exhaust gases, after purification, supplied water vapour, oxygen and nitrogen in a heated condition to the plants. The electricity generated operated arc lights equipped with special reflector hoods having a water screen at the open end to secure as near an imitation of natural solar effect as possible and to limit the ultra-violet rays. These arc lights were moved to and fro along the length of the glasshouse. The electrostatic machine, driven from the gas engine shaft, supplied energy which was discharged by points located along the plants, the object being the electrification not only of the air of the glasshouse but of the plants and their roots as well. I wonder if they survived.

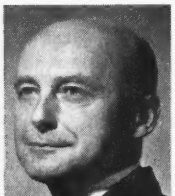
PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Aluminium Development Association announces that **Mr. S. E. Clotworthy,** managing director of the Northern Aluminium Co., Ltd., has succeeded **Mr. W. Fraser Bruce** as the representative of that company on the Council of the Association. **Mr. B. L. Page,** a director of John Dale, Ltd., has succeeded **Mr. J. F. Paige,** managing director of William Mills, Ltd., until his recent retirement, as the representative of the aluminium founders' organisation, L.M.F.A. Development, Ltd. The Council has appointed to the Executive Committee **Mr. R. T. Raven,** works director of Birmetals, Ltd., as the representative of Birmid Industries, Ltd., in place of **Mr. H. Goodwin,** who has retired; and **Mr. D. James** (T.I. Aluminium, Ltd.) in place of **Mr. W. H. Bowman.**

Mr. Guy Campbell has resigned from the board of Holophane, Ltd., as from 30th June. During more than twenty years Mr. Campbell has served as a director and for almost the whole of that time he was chairman of the board. **Mr. S. English,** D.Sc., F.Inst.P., M.I.E.E., has been elected chairman in his stead. He has served the company for more than 20 years, successively as technical director, joint managing director, and vice-chairman.

Mr. H. G. Boullen, B.Sc.Tech., A.M.I.E.E., has been appointed sales director of Lancashire Dynamo & Crypto, Ltd. Mr. Boullen was educated at Bowdon College, Manchester Grammar School, and Manchester University, and after serving an apprenticeship at the Trafford Park Works of Lancashire Dynamo he joined the company's sales staff, becoming in 1929 manager for the Nottingham area. In 1954 he was appointed the company's home sales manager. He will continue to operate from the London office of the company, and will be assisted by Mr. A. L. B. Arnold, A.M.I.E.E. (home sales) and Mr. J. E. Yates (export sales).



Mr. H. G. Boullen

Mr. W. U. Hancock, M.B.E., A.M.I.E.E., who has been Admiralty regional electrical engineer, north western region, for seventeen years, retired on 22nd July after fifty years' service in the Electrical Engineering Department of the Admiralty. Mr. Hancock entered the Royal Dockyard at Pembroke in 1907 and served in many positions at home and abroad before he was appointed to Manchester on the outbreak of the last war. He was guest at a dinner given in his honour at the Waldorf Hotel, Manchester, on 18th July by his friends and colleagues in Admiralty headquarters and regional staffs. On their behalf he was presented by Mr. J. C. Thompson, deputy director of electrical engineering, Admiralty, with a wrist watch.

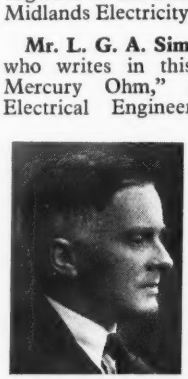
The Worshipful Company of Tinplate Workers announces the award of travelling scholarships for 1957 (value £50) to the following:—G. Crowther, employed by John Rigby & Sons, Ltd., presented by I. I. & S. W., and sent to James Booth & Co., Ltd.; J. O. Crane, employed by Guest, Keen & Nettlefold (S. Wales), Ltd., presented by I. I. & S. W., and sent to Enfield Rolling Mills; B. England, employed by Yarrow & Co., Ltd., presented by W. T. Henley's Telegraph Works Co., Ltd., and sent to British Railways, Swindon; T. S. G. Carruthers, employed by Yarrow & Co., Ltd., presented by W.T.B.M.A., and sent to the Metropolitan-Vickers Electrical Co., Ltd.; B. Kemp, employed by W. T. Henley's Telegraph Works Co., Ltd., presented by C.C.A., and sent to International Combustion, Ltd.; D. A. Kendall, employed by W. T. Henley's Telegraph Works Co., Ltd., presented by C.M.A., and sent to John Thompson, Ltd.; G. A. White, employed by British Railways, presented by B.T.C., and sent to Yorkshire Copper Works; P. I. Lewis, employed by A. C. Hart, presented by the E.T.U., and sent to Metropolitan-Vickers Electrical Co., Ltd.; D. A. Kidd, employed at Sculcoates power station, Hull, presented by C.E.A., and sent to Yarrow & Co., Ltd.; P. E. Turner, employed by British Railways, presented by B.T.C., and sent to the Welsh Sheet & Plate Manufacturers' Association; T. McMillan, employed by John Thompson, Ltd., presented by W.T.B.M.A., and sent to Enfield Cable Works; E. G. Rippin, employed by R. E. M. E. Chilwell, presented by the E.T.U., and sent to W. T. Henley's Telegraph Works Co., Ltd.

Mr. H. Neville Davies, press officer to Kelvin & Hughes, Ltd., for the past five years, has relinquished that post to become editor of the English Electric house journal.

Mr. M. Seaman has moved from the board of British Oxygen Engineering, Ltd., to the board of British Oxygen Gases, Ltd., where he will be director responsible for equipment manufacture.

Mr. G. E. Kemp, Associate I.E.E., has been elected chairman of the Birmingham Centre of the Illuminating Engineering Society for the ensuing year. Mr. Kemp is district commercial engineer of the Dudley District of the Midlands Electricity Board.

Mr. L. G. A. Sims, D.Sc., M.I.E.E., who writes in this issue on "The Mercury Ohm," is head of the Electrical Engineering Department, Southampton University, and is chairman-elect of the Southern Section of the Institution of Electrical Engineers. He took the B.Sc. degree with 1st class honours and a research scholarship in 1924 at Birmingham University and later proceeded to M.Sc. with an award of a research prize. Dr. Sims joined the Research Laboratories of the General Electric Co., Ltd., and was subsequently on the staff of Birmingham University where he founded the electronics laboratories and teaching courses in high frequency experiments, including transmission from the University tower on short wavelengths. He initiated and directed researches upon the incremental properties of magnetic steel which led to B.S. No. 933 : 1941—"Magnetic Materials for Use under Combined D.C. and A.C. Magnetisation." On the power engineering side he was interested in energy storage with the a.c. system of supply, and initiated research upon electro-thermal storage leading to publications and a patent specification which anticipated some of the present work on electro-storage heating.



Dr. L. G. A. Sims

From 1936 to 1939 Dr. Sims was Head of the Electrical Engineering Department of the Northampton Polytechnic in London. He has held senior teaching appointments in the Government service at the Royal Naval College and at the Royal Aircraft Establishment. He served overseas in the Railway Division, R.E., during the first world war, and was in Admiralty service from 1939 to 1946.

The Executive Council of the Association of Supervising Electrical Engineers has announced the result of the annual competition for the W. E. Highfield Shield. The adjudicators were Sir Harold Bishop (president),

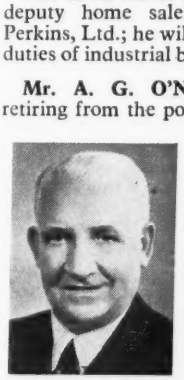
Mr. Bryan Donkin (immediate past-president), Mr. G. H. Parker (national chairman) and Mr. R. F. Mathieson (chairman, Technical Committee), and they awarded the shield and the cash prize of £10 10s to **Mr. D. H. Taylor,** A.M.I.E.E., Grad.I.Mech.E., of New Barking, Essex, for his paper "Nuclear Power Developments." Sir Harold Bishop will present the shield to Mr. Taylor, together with other awards made to winners of the Association competitions, at the first meeting in the 1957-58 London national lecture programme which is to be held at the Institution of Electrical Engineers on 29th October.

Mr. G. G. Roberts, M.Sc., A.F.R.Ae.S., formerly director of research to Smiths Aircraft Instruments, Ltd., at Cheltenham, has now been appointed technical director in succession to **Mr. E. B. Moss.** Mr. Roberts joined Smiths three years ago and headed the company's Guided Weapons Department. He was appointed to the board as director of research last October.

Mr. J. C. Swallow, Ph.D., B.Sc., A.M.I.Chem.E., F.R.I.C., F.P.I., has been elected president of the Plastics Institute for 1957-58, and **Mr. J. V. Crossley,** M.Sc., J.P., has been elected chairman of the Council.

Mr. G. R. Guest has been appointed deputy home sales manager of F. Perkins, Ltd.; he will retain his present duties of industrial branch manager.

Mr. A. G. O'Neill, M.I.E.E., is retiring from the position of managing director of Nalder Bros. & Thompson, Ltd., which he has held for the past twenty-two years. He is remaining as chairman of the company, a post to which he was elected in 1945. Mr. O'Neill joined the company in 1899. He has served as a member of the B.E.A.M.A. Council, as chairman of the Instrument Section and is a member of various B.S.I. Technical Committees. On Wednesday last a cocktail party was held at the company's new test room at which a presentation was made to Mr. O'Neill.



Mr. A. G. O'Neill

The Electrical Association for Women has appointed **Mrs. M. L. Lester** as area organiser for the North Eastern Area. She takes up her appointment on 1st September.

For some years past the Cricket Club of the **Sterling Cable Co., Ltd.,** Aldermaston, Berks., has played a match against a Surrey County team, and this year it was held on the company's sports ground on 21st July. The Surrey team included all their first team players with P. B. H. May (captain of England and Surrey). The Sterling team, which included sixteen players, scored 113 for 15, to which Surrey replied with 297 for 6.

Thorn Electrical Industries, Ltd., has appointed **Mr. S. A. Gibbons** as chief engineer of the Bendix Connector Division, which is part of the aircraft components group. Before joining the Plessey Co., Ltd., in 1946, Mr. Gibbons was a member of the research development staff of the Ministry of Aircraft Production. Whilst with the Ministry and the Plessey Co. he was an active member of many technical panels and committees and for the past nine years has been chairman of Panel "J," Radio and Electronic Component Manufacturers' Federation.

Mr. S. A. Gibbons

For their annual visit this year members of the **Ipswich and District Electrical Association** recently went to the B.B.C. Television Centre, Wood Lane, London, where they were the guests of the Television Engineering Information Department. Some 24 members attended and, following lunch, they were conducted on a "behind the scenes" tour of the Centre and to associated departments (Tele-Ciné Section, Monitoring Sections, Stage/Production/Transmission link). The visit was organised by the president of the Association, Mr. C. T. Melling, and Sir Harold Bishop, head of the Engineering Division of the B.B.C. Television Department. Mr. R. A. Jackson, district manager of the Eastern Electricity Board, Ipswich, expressed the members' thanks to the B.B.C.

Mr. M. Clough has been appointed engineer-in-charge of the new television transmitting station at Rosemarkie, Inverness-shire. He was previously on the staff of the Meldrum television station.

Mr. P. W. Faulkner, O.B.E., general manager of the Chemical and Metallurgical Division, Towcester, Northants, of the Plessey Co., Ltd., has been appointed an executive director of the company. Mr. Faulkner joined Plessey in 1952 at its head office, Ilford, and took up his managerial position at Towcester in 1953. He will continue to be in charge of the Chemical and Metallurgical Division. He is also a director of Technical Ceramics, Ltd.

Mr. P. W. Faulkner

The Eastern Area final of the **Electrical Industries National Golf Championship** was held on 24th July at the Letchworth Golf Club, Letchworth, Herts., and the following qualified for the national final on 30th September:—Winner, Mr. G. Wilbraham; runner-up, Mr. J. L. Taylor; best scratch score, Mr. A. Love.

There was a large gathering at the first post-war Exide sports and gala day of **Chloride Batteries, Ltd.,** held on 20th July at the Chloride Recreation Club, Clifton, Manchester. The proceedings opened with a parade of veteran cars, after which there was a comprehensive programme of athletics. Other attractions were an arts and crafts exhibition, a horticultural show, tennis and bowls tournaments and sideshows. The prizes were presented by Mr. C. G. F. Pritchett, director of Chloride Batteries, Ltd., and the day was rounded off with dancing and a concert.

As a result of the Midlands area final of the **Electrical Industries National Golf Championship** held on 26th June a sum of over £400 has been collected for the Electrical Industries Benevolent Association.

OBITUARY

Mr. V. J. F. Brain.—The death occurred on 11th June at Sydney, Australia, of Mr. Vivian James Foxton Brain, chairman of the Electricity Authority of New South Wales. Mr. Brain was previously chief electrical engineer of the N.S.W. Public Works Department and took up his appointment with the State Electricity Authority on its formation in 1946.

Mr. N. Mendess, for many years with Thermodare (Great Britain), Ltd., died on 20th July. Before joining the company he was with Eastwoods, Ltd., and the Ministry of Supply.

Mrs. I. Walchester.—The death occurred on 23th July at the City General Hospital, Stoke-on-Trent, of Mrs. I. Walchester, who was well known in the Midlands as a sales engineer for the Simplex Electric Co., Ltd.

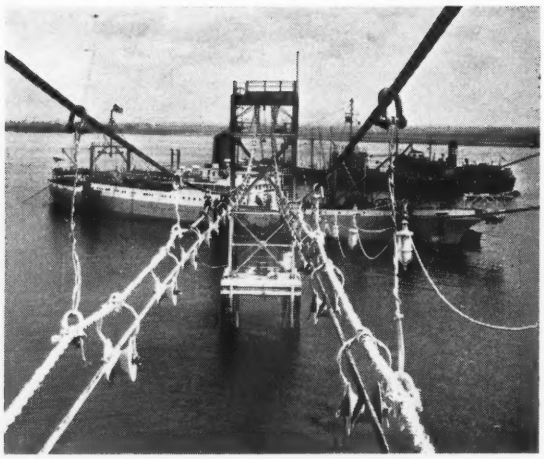
WILLS

Sir Alfred Edward Herbert, K.B.E., founder, chairman and managing director of Alfred Herbert, Ltd., who died on 26th May last, left £5,336,052 gross (£5,214,989 net).

Mr. A. Fitzsimmons, A.M.I.E.E., labour superintendent and chief rate fixer with the Micanite & Insulators Co., Ltd., who died on 26th April last, left £12,836 gross (£12,249 net).

Mr. R. Shaw, A.M.I.C.E., A.M.I.E.E., consulting engineer, who died on 21st February last, left personal estate in England and Scotland valued at £10,430.

Mr. H. Hyde, A.M.I.E.E., superintendent of Kingston power station, who died on 9th February last, intestate, left £6,718 gross (£5,068 net).



California-Hawaii telephone cable being loaded on the cableship "Ocean Layer"

Pacific Telephone Cable

NEARLY half of the first submarine telephone cable link between California and Hawaii was produced by Submarine Cables, Ltd. (owned jointly by Siemens Bros. & Co., Ltd., and the Telegraph Construction & Maintenance Co., Ltd.) at its Erith factory in Kent for the American Telephone & Telegraph Company.

The route distance between the two landing points, namely, Point Arena, north of San Francisco, and the Island of Oahu, in the Hawaii group, is approximately 2,200 nautical miles and there will be two cables, one for each direction of transmission. Fifty-seven underwater repeaters or speech amplifiers are spliced into the cable at intervals of 38 nautical miles. The laying of the first cable will be completed this week.

The 2,020 nautical miles of cable, costing over £2,500,000, which were shipped on board the Post Office cableship H.M.T.S. *Monarch* (1,070 nautical miles) and the cableship *Ocean Layer* (950 nautical miles) belonging to Submarine Cables, Ltd., in May and June last. The cable was manufactured, underwater repeaters from America spliced in and the cable shipped on board the cable-laying vessels in 10 months. This polythene insulated coaxial type cable is designed to provide the same number of telephone channels, namely, 36, as the first transatlantic telephone cable, the greater part of which was also produced by Submarine Cables, Ltd.

Structure of Cable

The "core" of the Pacific cable consists of polythene extruded over a central copper conductor composed of a 0·131in wire surrounded by three tapes 0·0145in thick. The diameter of the core is 0·620in. Surrounding this is the outer or return conductor, consisting of a layer of six copper tapes applied with a long lay, and held in position by a copper binder tape and a protective tape applied with a short lay. The jute serving, galvanised steel armour wires, and outer serving depend on the depth and sea bed conditions in the locality for laying. For the deep-sea cable an armour of 24 wires of 0·086in diameter is used, each wire being protected by a coating of compound and an impregnated fabric tape. The overall diameter of the cable is 1·2in, and the weight 62 cwt/n.m. in air or 36 cwt/n.m. in water.

For intermediate depths and shallow water heavier armour is used and double armour for shore ends where a rocky bottom is encountered. Power to operate the repeaters is supplied by a direct current fed from the ends of the cable through the inner conductor; 2,200 V positive will be applied at one end and 2,200 V negative at the other.

Stringent Manufacturing Requirements

Extreme accuracy of manufacture and measurement of the cable is required, as is shown by the following considerations. The attenuation of 2,200 n.m. of cable is approximately 1,000 and 3,600 decibels at the lower and higher end, respectively, of the transmitted frequency band. The transmission level at any frequency must be maintained so as to avoid overloading repeaters at high levels or running into interference at low levels. Consequently the variation of attenuation with frequency must be accurately equalised at each repeater. Moreover, prediction of temperature and pressure at sea-bed conditions is required, as the cable characteristics depend appreciably on both these variables. Another consideration is that the deep-sea repeaters do not include matching units, which means that their gain would be affected by irregularities of cable impedance due to reflections. Hence manufacture must be stringently controlled to obtain as uniform a cable as possible.

Most of the Pacific route traverses deep water (up to nearly 3 miles) and it was necessary to increase the tensile strength of the cable by the use of extra high tensile steel armouring wires. By this means an additional 2 tons was added to the breaking load of the cable compared with the transatlantic telephone cable.

The similarity of the structure of the new cable to that of the Atlantic cable enabled production to follow on without any major interruption. Continued experience in working to the exacting specification at Ocean Works, Erith, resulted in a product of even greater uniformity than has ever before been achieved. In addition, certain economies in manufacture were effected that were not possible in the transatlantic cable.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton	£197 0s 0d
COPPER, H.C. Electro	ton	£216 15s 0d
Fire Refined 99·70%	ton	£215 0s 0d
Fire Refined 99·50%	ton	£214 0s 0d
COPPER Tubes	lb	2s 1⅛d
Sheet	ton	—
H.C. wire and strip	ton	£270 5s 0d
LEAD, English	ton	£91 10s 0d
Foreign	ton	£90 0s 0d
MERCURY	flask	£87 0s 0d
TIN, block (English)	ton	£746 10s 0d
ZINC, G.O.B. Foreign	ton	£74 0s 0d
Electrolytic	ton	—
BRASS Tubes (solid drawn)	lb	1s 9d
Sheet	ton	—
Wire	lb	2s 5⅛d
PHOSPHOR BRONZE Wire	lb	3s 9⅛d
PLATINUM	oz	£31 0s 0d
RUBBER, No. 1 R.S.S. spot	lb	26⅜d—27d

Fuel Efficiency Conference

A conference will be held by the Combustion Engineering Association on 5th and 6th November next at the Old Swan Hotel, Harrogate, Yorks. The purpose is to examine the third annual report of the National Industrial Fuel Efficiency Service and to show where the greatest savings in the use of fuel can be made.

PARLIAMENTARY REPORT

British Transport Contracts

Replying to questions in the House of Commons last week on the results of his consultations with the British Transport Commission in regard to the placing of contracts for the modernisation programme, the Minister of Transport (Mr. Harold Watkinson) said that at his request the chairman of the Commission had sent him a full report. It set out the new purchasing policy which the Commission decided to adopt on 30th May last and also dealt fully with allegations made in the House about specific contracts. Because of the importance of this issue he had felt it essential to ensure that the facts were established expertly and impartially and he had asked Sir Harold Howitt, past-president of the Institute of Chartered Accountants, to examine this matter and let him have his views upon it as soon as possible. The Minister said it was his intention to publish the findings and the Commission's report.

Cost of Railway Modernisation Plan

Mr. Ernest Davies asked the Minister of Transport to what extent the estimated cost of £1,200 million for the British Railways modernisation programme was now expected to be exceeded, in view of the subsequent rise in the general level of prices.

Mr. Watkinson said the British Transport Commission was now reassessing the cost of the programme, to take account of the fact that it was ahead of the original schedule and that recent major technical decisions had altered its scope.

Hire-Purchase Deposits

Mr. Osborne asked the President of the Board of Trade if, as a step towards combating inflation, he would increase substantially the deposit required on all hire-purchase agreements, and reduce the time and number of payments to complete them.

Sir David Eccles replied, "No, sir."

In answer to another question he said the outstanding hire-purchase debt fell by some £90 million during 1956 and had risen by the end of May this year by £12 million. He did not think that this was a very serious challenge.

Grants to Farmers

The Agricultural Bill, which provides for Government grants to be given to aid farm improvements, has now completed its passage through both Houses. The provision of electric light and power is one of the improvements eligible for a grant, and when Lord Wise, in the House of Lords, sought to get this extended to the provision or improvement of heating equipment he did not succeed.

Earl St. Aldwyn, Parliamentary Secretary, Ministry of Agriculture, said that the Government must exclude short-lived material of this sort.

Scientists and Defence

In reply to Mr. George Brown, the Minister of Defence (Mr. Sandys) said that the number of scientists and technicians employed in the defence departments had been reduced by 800 since the beginning of this year, and the process would continue.

Trade with Canada

Mr. Geoffrey de Freitas asked the President of the Board of Trade what changes he had made in the staffing of the United Kingdom Trade Commissioner's office in Canada so that greater help could be given to exporters who wished to increase their sales in Canada.

Sir David Eccles said that British commercial representation in Canada was kept under constant review. There had been an increase in strength during the last three years, bringing the total to almost four times pre-war. According to the reports which he received from many sources the present arrangements were working satisfactorily.

Inflation and Nationalised Industries

During the debate on inflation the Chancellor of the Exchequer, Mr. Peter Thorneycroft, in answer to Mr. Gerald Nabarro, said that it was possible, if one searched the investment programme of any industry, private or public, to find some examples of extravagance but in his judgment the investment programmes of the nationalised industries were not the cause of inflation; they were the necessary basis of the expansion of production which was needed to overcome it.

Mr. J. Grimond, leader of the Liberal Party, said he would like to see the Government develop a more coherent wage pattern in the nationalised industries in which an attempt was made to relate wages more directly to productivity.

In his reply to the debate, the Prime Minister, Mr. Harold Macmillan, said that there were very good men both at the top and throughout the nationalised industries. "I do not think that we help very much by nagging criticism of them," he said, "but I would say that they are really in a sheltered position. In the old days, we used to have a contrast between the sheltered industries and those not sheltered. The nationalised industries are certainly sheltered and, because they are, they have a special duty not to exploit the nation. Similarly with their investment, they are not able yet—some of them may be earlier than we think and I hope they may be—able to face the test which faces ordinary industry in the market when seeking public subscriptions of money. It is, therefore, our duty to apply to them a special scrutiny, and this we have done and will continue to do."

Restrictive Practices Proceedings

Mr. Du Cann asked the Attorney General if he would make a further statement on the Restrictive Practices Court.

Sir R. Manningham-Buller replied that proceedings had been started in twenty cases. The work involved in preparing them for trial was very considerable and it was most unlikely that any of them would be ready for final hearing before the early part of next year.

Mr. Du Cann pointed out that the Act received the Royal Assent over a year ago. Would the Government see if the proceedings could be expedited?

Sir R. Manningham-Buller said he was certain they could not be expedited, in view of the close consideration that had to be given to a vast amount of documents. He was sure Mr. Du Cann would wish that proper investigation should be made before the cases were presented, so that justice and the requirements of the Act were complied with.

Engineers in the Radio Industry

Captain Pilkington asked the Minister of Labour for an estimate of the shortage, now and anticipated, of engineers in the radio industry.

Mr. Macleod said that on 19th July there were 392 unfilled vacancies for professional engineers in the radio industry, and on 17th June there were 950 unfilled vacancies for electronic technicians and craftsmen. The latter vacancies covered other industries as well as the radio industry. Not all vacancies were notified to his offices. He had no recent information on which a reliable estimate of the future demands of the industry could be based.

Fleet-Drakelow Line

Lord Lucas of Chilworth asked the Government if they would state the cost of the Fleet-Drakelow 275 kV supergrid line up to the time of its abandonment.

Lord Mills said the proposal had not gone beyond the planning stage and the cost had been confined to the preliminary work done by the Authority's own planning engineers and their administrative and wayleave staff. The amount of money involved was therefore small.

In the Courts

Certification of Fuses : Alleged Misrepresentation

Mr. K. Dannenberg, of the Ridgeway, Friern Barnet, and E.M.P. Electric, Ltd., of Garman Road, Tottenham, were committed for trial at the Central Criminal Court on 10th September by Tottenham Magistrates on Wednesday last week after three lengthy hearings of summonses by the Board of Trade alleging that E.M.P. Electric had applied false trade descriptions to four fuses and that Mr. Dannenberg had caused the company to apply such misrepresentation.

Counsel for the defence, Mr. M. Finer, said that his clients would reserve their defence. A plea of not guilty would be entered. Mr. Dannenberg was allowed bail on his own recognisance of £50.

Witnesses at the hearings included Mr. G. D. Leeder, an A.S.T.A. testing observer and research engineer at W. T. Henley's Gravesend Laboratories. At a hearing on Tuesday, counsel for the defence had asked Mr. Leeder to accept the assumption that three fuses given A.S.T.A. certificates by George Ellison, Ltd., were of identical types to three fuses disqualified by Henley's. According to A.S.T.A. regulations, the test of a fuse should cover all fuse types of similar design.

The witness refused to accept the assumption on the grounds that he did not know whether the fuses mentioned were of similar design.

Counsel suggested that the mounting of the fuses as used by Henley's on this occasion did not have the rigidity required for A.S.T.A. testing. "I did not have the type of mountings which I usually use for A.S.T.A. testing," the witness replied, but he could not agree that the mountings were below the required rigidity.

Mr. Leeder thought it possible that the fuses had been "knocked about a bit" when he received them. The fact still remained that the fuses he tested did not come up to A.C.5 standard.

Continuing his cross-examination of Mr. Leeder on Wednesday, counsel for the defence asked him to assume that hundreds of thousands of E.M.P. fuses had been sold over the past year and that a proportion of these were A.C.5 types; that E.M.P. had spent £2,000 on A.S.T.A. tests and £16,000 on K.E.M.A. performance tests and by and large those tests had been satisfactory. "On these suppositions isn't it strange that three out of four fuses, selected at random, and tested by you, failed?" counsel asked.

On the suppositions it was strange, the witness replied, but it would need substantiating that all these fuses were of identical construction. He was convinced beyond doubt that in the case of the 400 A fuse, any fuses of identical construction to the one he tested would fail in any other station, with any other type of mounting.

The witness said that he knew nothing of one untested fuse link which, it was alleged by Mr. Finer, had a fine metal deposit on the outside when the witness had spoken to a Mr. Humphries on 15th May. Such a deposit would cause flash-over ranging from negligible to substantial, witness agreed. He denied that the fuse had been "cleaned up" between 15th May and the present date.

Mr. Leeder, who had been an A.S.T.A. observer since Henley's was accepted as a testing station, agreed that it would become commercially impracticable if every alteration to a fuse required certification. Witness agreed with counsel for the Board of Trade, Mr. Neville Faulks, that the method of mounting shown in the photograph of the A.S.T.A. certificate from Ellisons was substantially similar to the method of mounting employed by Henley's in their test. Therefore a previous remark concerning the "makeshift" nature of Henley's test could also be applied to George Ellison's test.

Mr. J. C. Stebbing, secretary to A.S.T.A., said in evidence that he had known that no certificate was held by E.M.P. for a 600 V fuse advertised in the trade Press. He knew E.M.P. held a certificate related to a 440 V type.

In May, 1956, he made arrangements for certain fuses produced by Mr. Howard to be tested by Mr. Leeder at Henley's. He was present with Mr. Howard when Mr. Leeder tested them. The test was carried out with "meticulous care" and he was aware that the result of the test was that all failed except the 200 A fuse. If these fuses had been metalclad and had exploded in the way those on test exploded, there might be continuation of arcing which would cause severe burning of the outer casing and red hot metal to be showered over quite a large area, or the cover of the equipment to be blown right off, said Mr. Stebbing.

Ayrshire Nuclear Station Approved

Mr. J. S. Maclay, Secretary of State for Scotland, announced on Tuesday last that he had decided that it would be in the national interest to grant an application by the South of Scotland Electricity Board for permission to construct a nuclear generating station at Hunterston, Ayrshire. Permission should be subject to certain conditions and certain undertakings by the Board.

The report of the Commissioner, Mr. H. R. Leslie, who succeeded the late Sir Randall Philip, Q.C., who died before completing his report, recommends approval in principle of the application, and says that the cost of the project is in the region of £37 million. The report also says that planning permission for the station might properly be given, subject to certain conditions, and a compulsory purchase order for the station confirmed with certain exclusions. The precise siting of the station on areas to be compulsorily acquired, and architectural features, should be discussed with the Amenity Committee of the Board and with the Royal Fine Art Commission for Scotland. Pylons should be sited in consultation with the Committee and/or the Commission. Tree planting as useful screening merited consideration.

On the question of nuclear safety the report says that while no danger was apprehended it would seem entirely proper to observe the maximum safeguards. Some aspects at least were doubtless still exploratory. No slackness or negligence could be tolerated with regard to the exhaust of gases into the air or the discharge of radioactive cooling water or waste into the sea, nor in the treatment and removal of the spent fuel. The conclusion was irresistible that the Hunterston site afforded very satisfactory features from the civil engineering point of view and also as regards access and the general functioning and operation of the station. An alternative site at Turnberry Point, on the Ayrshire coast, would involve an additional capital cost of £1,500,000.

On the subject of amenity the report states: "There is no doubt that the vital point from the amenity aspect is that the natural silhouette of the hills and promontory should not be violated. . . . The result of the evidence is undoubtedly to the effect that if the whole complex could be moved a little the site at Hunterston could probably be acceptable, assuming the site to be otherwise justified." The extra cost—because of differing ground levels—might be of the order of £400,000, which might be well justified to safeguard "this superbly fine stretch of coast and island scenery."

INDUSTRIAL NEWS

Iron and Steel Price Increase

Under the Iron and Steel Board Price Determination, 1957, No. 3, which came into effect on Monday last, maximum prices of iron and steel products have been increased by an average of 7½ per cent. It is estimated that the new prices will yield an additional £67 million a year, including £10 million from overseas consumers. The last increase was in December, 1956, when prices were raised by about 6 per cent.

The Minister of Power, after consultation with the Iron and Steel Board, has made the Iron and Steel Scrap (Amendment No. 1) Order, 1957 (Statutory Instrument 1957 No. 1271), amending the Iron and Steel Scrap Order, 1956. This increases the maximum prices of all specifications in the schedule by an average of £1 per ton and takes account of the increases in railway freight rates which come into force on 1st August. The order took effect on 29th July. Copies (price 9d) are obtainable from H.M. Stationery Office.

Exchange of Atomic Information

The United Kingdom Atomic Energy Authority announces that an agreement has been signed between the Authority and the South African Atomic Energy Board for co-operation in promoting the peaceful use of atomic energy. The agreement provides for information to be exchanged on the progress and economics of nuclear power in the two countries and on a number of other topics which are of importance in connection with South Africa's programme of nuclear research and development. It also provides for assistance in training South African scientists and engineers in the United Kingdom, and for the attachment of two South Africans to Harwell to do research on methods of producing heavy water, with a view to its possible production in the Union.

British Plastics Exhibition

The attendance at the recent British Plastics Exhibition held at Olympia, London, was 90,000 and included some 6,000 overseas visitors. This was more than double the attendance at the 1955 show. Mr. C. E. Wallis, chairman and managing director of Associated Iliffe Press, whose journal *British Plastics* organises the exhibition, said that the exhibition had grown steadily in size and importance in close step with the development and expansion of the industry. The decision to admit overseas firms to this year's show proved to be a wise one, and the next exhibition, to be held in June, 1959, would follow the same pattern. The British Plastics Convention, run concurrently, was again a success and all sessions were well attended.

Export Licensing Control

The Board of Trade announces that the Strategic Goods (Control) (Amendment No. 4) Order, 1957 (S.I. 1957 No. 1,282, H.M. Stationery Office, price 3d) has been made under which licences will be required for the export to all destinations, other than the Commonwealth, the Irish Republic and the United States, of certain types of centrifugal testing apparatus, specified forms of polytetrafluoroethylene and polytrifluorochloroethylene, and certain equipment designed to produce printed circuits (electronic assemblies).

Visit to Crawley Factory

During a visit last week to the Crawley Works of F. H. Bourner & Co. (Engineers), Ltd., representatives of the Press saw a variety of devices in the course of production. They included "Supataps," hose clips and oil radiators. Of interest to electrical contractors are the "Supadrive" hand-operated driving tool for use in brick, breeze and concrete walls and the "Supadynamic" cartridge-operated driving tool. The latter incorporates two methods of firing, direct drive and the piston method which is used when it is required to control the depth of penetration of a pin or crimp into steel.

Irish Automatic Control Gear Manufacture

The Northern Ireland Development Council has announced that work is to begin on a new factory which the Ministry of Commerce is to build and let to Lee Guinness, Ltd. The factory will be on a site near the company's existing factory at Newtownards, Co. Down, and will produce automatic control gear.

Commenting on the arrangements, Mr. A. H. Willetts, managing director of Lee Guinness, Ltd., said a full range of automatic control gear of the type used in atomic power stations, chemicals, steel mills, oil refinery plants, cement manufacture, paper mills, etc., would be made.

Rheostatic Company's Conference

The second European conference of the Rheostatic Co., Ltd., was held from 1st to 4th July at the company's works at Slough and was attended by twenty delegates from associated companies and concessionaires in Europe, representing eleven countries. The business of the conference covered many aspects of export trade, including the introduction of new products and future development plans which were the subjects of several sessions. The conference was opened by Mr. M. J. Gartside, chairman and managing director.

Royal Welsh Show

During the Royal Welsh Show at Aberystwyth a visit was paid by Mr. Henry Brooke, Minister for Welsh Affairs, to the exhibits arranged by the Merseyside and North Wales and the South Wales Electricity Boards in conjunction with the Electrical Development Association. We reproduce a photograph taken on the occasion.

Mr. J. Rankin, O.B.E., deputy chairman of the Merseyside and North Wales Electricity Board (left), showing Mr. Henry Brooke the dairy equipment in the electrical exhibit at the Royal Welsh Show

Low Temperature Heaters

Details are given below of the range of electric convector heaters manufactured by Ferranti, Ltd., Domestic Appliance Sales, Moston, Manchester, 10, which were inadvertently omitted from the survey of low temperature heaters published in last week's issue.

Model C.F.5168: a portable 1 kW heater measuring 17½in high by 19in wide by 6½in deep. It is fitted with indicating lamp and safety device to prevent overheating, the casing is of sheet steel finished in hammered bronze and the price is £4 19s 6d plus £2 3s 9d purchase tax.

Model C.F.6180: a portable 2 kW thermostatically controlled heater 23⅞in high by 23in wide by 7½in deep. The steel casing has a golden bronze hammered finish with a copper fawn stoved enamel grille and the price is £7 6s 3d plus £3 4s 2d purchase tax.

A recent addition is model C.F.6180S, a non-thermostatically controlled type similar to the C.F.6180 but fitted with a half-heat switch. This model is priced at £7 1s 3d plus £3 1s 11d purchase tax.

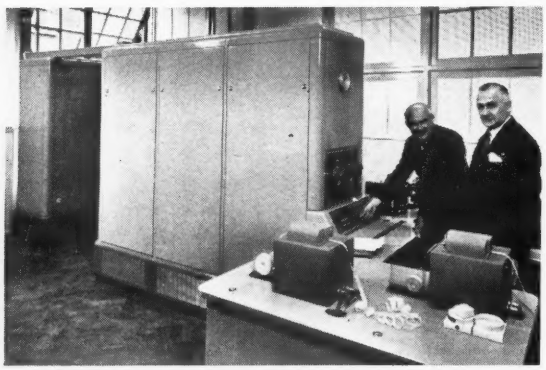
Production Engineering Courses

A scheme for full-time courses leading to the award of a higher national diploma in production engi-

neering has been arranged by the Ministry of Education in conjunction with the Institution of Mechanical Engineers and the Institution of Production Engineers. Local education authorities and technical colleges have been informed of the rules and conditions governing the award of the new diploma.

Computer for Technical College

A new "Pegasus" electronic digital computer made by Ferranti, Ltd., was officially handed over to the Northampton College of Advanced Technology on 18th July by the managing director of the National Research and Development Corporation, Lord Halsbury, to celebrate the College's higher technological educational status. Previously the College was known as the Northampton Polytechnic. It was the first day of the College's "open week" during which new equipment was displayed to representatives of industrial, commercial and educational organisations.



Dr. J. S. Tait (right) principal of the Northampton College of Advanced Technology, watching a demonstration by Mr. F. Keay (Ferranti, Ltd.) of the new electronic digital computer

Special Technological Courses

The London and Home Counties Regional Advisory Council for Higher Technological Education has published a booklet giving details of special courses in higher technology arranged for the autumn term. Copies are obtainable from the secretary of the Council, Tavistock House South, Tavistock Square, London, W.C.1.

Policy on Public Ownership

Two booklets, "Public Enterprise" and "Industry and Society," published recently by the Labour Party, price 1s each, deal respectively with the nationalised industries and future public ownership. Both statements of policy will be considered at the annual conference of the Labour Party at Brighton in October.

The Study Group concerned with the nationalised industries is satisfied that the foundations laid during the last ten years are sound and reference is made to the impressive technical record of these industries. A summary of future policy states that the Party will review changes to and restrictions placed on the Boards; in particular, the electricity supply industry will again be enabled to manufacture necessary equipment; the secretaries of consumer councils should not be drawn from the staffs of Boards; the idea of joint fuel and power councils is rejected, although it is recognised that more effective liaison is needed between them; there is no strong case for changing the present system of parliamentary accountability; periodic inquiries should continue but at about ten, not seven, year intervals; and as far as possible the industries—particularly electricity and coal—should meet more of the cost of new investment out of their surpluses.

The booklet on future public ownership states that the case for nationalisation of the long-distance road haulage and steel industries is as strong as ever and they will therefore be restored to public ownership. Other ways in which public ownership may be expanded include the State purchase of shares at their market value. The document goes on to say that the great majority of large firms are already serving the nation well and that there is no intention of intervening in the management of any firm which is doing a good job.

Piston Ring Manufacturers' Jubilee

On 17th July, Hepworth & Grandage, Ltd., opened a new office and warehouse, which has been completed at a cost of £750,000, at its St. John's Works, Bradford. The opening ceremony was performed by Stirling Moss and the guests at the luncheon, which also marked the golden jubilee of the company, included the Lord Mayor and Lady Mayoress of Bradford and a number of well-known personalities who have established speed records in the air, on the water and in motor racing. Speaking after the luncheon, Mr. J. L. Hepworth, joint managing director, said that the company had grown from three employees in 1907 to 4,500 in 1957. Ald. H. Weston, J.P., spoke on behalf of the guests.

The company was formed in April, 1907, by Mr. E. Hepworth, sen., together with his sons George and William, and its first order was for pins for woodworking machinery. It began to concentrate on the manufacture of piston rings in 1910 and, as the company grew, other products were added including gas turbine blades, cylinder liners and grey iron castings.

Re-rating of Industry

The County Councils Association, in a memorandum on the Government's plan to increase industry's share of local rates, says it welcomes the proposal to reduce what it calls "the national subsidy given to industry at the expense of local rates." But, in the Association's view, nothing less than full rateability of industrial property at present de-rated is satisfactory.

Colliery Year Book

The 1957 edition of the "Colliery Year Book and Coal Trades Directory" is similar in arrangement to previous editions. The data in the standard and statistical sections has been thoroughly revised and, in addition to information on the coal-mines in Western Europe and the United States of America, details of coal mining in Poland and the U.S.S.R. have now been added. Full particulars of every coal mine in Great Britain, current information regarding the Ministry of Power and the National Coal Board, and the new Mines and Quarries Regulations, 1956, have been included. A foreword is contributed by Mr. J. Latham, deputy chairman of the National Coal Board. The Year Book is published by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, price 30s net (by post 31s 6d).

Robust Mine Signalling Key

A mine signalling key which has been recovered from a copper mine of the Emerald Isle Mining Co., Allihies, Co. Cork, after having been under 200ft of water for twenty-six years, has been returned to the makers, Gent & Co., Ltd., Leicester, with a testimonial from the engineer. Despite this prolonged immersion, the key is in working order except for the contact springs

A Gent mine signalling key recovered from a copper mine after being submerged in water for many years

which have rusted away. Although this key was only designed to be flameproof, the machining of the flanges was so accurate that the key proved to be watertight and suffered the minimum amount of corrosion internally. The copper mine ceased operation in 1929 and by 1930, due to the pumps not operating, water had reached the 200ft level. Some time ago explorations started at the mine with a view to re-opening it, and on pumping out below 200ft the engineer found the signalling key.

Harwell Course for Executives

The Isotope School at Harwell is arranging a three-day course from 25th to 27th September next for directors and senior executives from industry to enable them to hear about and discuss the many uses of radio-isotopes. The course will include visits to the Harwell reactors and to the Wantage Radiation Laboratories. There will be talks on safety precautions to be taken when using radio-active material, on some aspects of turning an ordinary laboratory into an "active" laboratory and on the economics involved. The emphasis throughout the course will be on the practical uses of isotopes and irradiation sources in industry.

Accommodation can be arranged for the nights of 24th, 25th and 26th September at Worcester College, Oxford, and transport to and from Harwell will be provided. The fee for the course will be £30 inclusive of accommodation, transport and meals. Further information about the course is available from the Registrar, Isotope School, Atomic Energy Research Establishment, Harwell, Berks.

Harland Acquisition

The Harland Engineering Co., Ltd., and Harland Drives, Ltd., announce the acquisition of a controlling interest in Simon Equipment, Ltd., electronic engineers, and Mr. L. Spiro and Mr. F. H. Maddox have joined the board of that company. The merger is a result of collaboration between the companies in the development and application of electronic equipment to specialist industrial electric drives.

Works Visit

His Excellency Dr. Mamoun Hussein Sherif, Minister of Communications of the Sudan, recently visited the Strowger works, Liverpool, of the Automatic Telephone & Electric Co., Ltd. He was accompanied by Sayed Syliman Hussein, Director of the Sudan Posts and Telegraphs Department, and Mr. W. S. Vick, deputy manager, works control, conducted the visitors round the works.

Wholesalers' New Showrooms

Hirst, Ibbetson & Taylor, Ltd., electrical wholesalers, recently opened new trade showrooms on the ground floor of a three-storey building adjoining their existing premises at 47-55, Chapel Street, Salford, Manchester. The building has been taken over by the company to provide additional storage space for its expanding appliance business, and the new showrooms provide a permanent display of domestic appliances. The formal opening was attended by dealers from Lancashire and Cheshire.

Part of the new showrooms of Hirst, Ibbetson & Taylor, Ltd.

E.A.W. Area Conference

The E.A.W. South Eastern Area Conference was held recently at Hove when an address of welcome was given at the luncheon by the Mayor, Ald. Clarke, J.P., and Miss Mary George, M.B.E. (director, E.A.W.) replied on behalf of the Association. "Nuclear Power as it will Affect the Lives of Women" was the subject of speeches by Sir Henry Self, deputy chairman (administration), Central Electricity Authority, and by Mr. N. Elliott, chairman, South Eastern Electricity Board. Mrs. Ruth Skinner, B.Sc., chairman of the Brighton and Hove Branch, presided at the luncheon.

Orders for Francis Turbines

Gilbert Gilkes & Gordon, Ltd., Kendal, have recently received a number of orders for hydro-electric equipment for the Canadian market. These include a 3,600 h.p. Francis turbine ordered by the Power Corporation of Canada, Ltd., for the West Coast Power Co.'s Lookout Brook plant, Newfoundland. L'Office de l'Electrification Rurale, Quebec, has ordered a 660 h.p. and two 720 h.p. Francis turbines for hydro-electric schemes in Quebec Province.

In Malaya, the Central Electricity Board is installing three 300 kW "Gilkes" hydro-electric units in its Robinsons Falls power station. These will be driven by 440 h.p. Pelton wheels working on a head of 740ft. This installation will form the first stage in the large Cameron Highlands development in Central Malaya.

Plymouth Corporation Water Department has ordered a 660 h.p. Francis turbine to operate on a head of 210ft and drive an induction generator feeding into the grid.

Among units recently commissioned are two 1,100 h.p. open type Francis turbines working on a head of 22ft at Tumatumari Falls in British Guiana. These turbines were installed by "Gilkes" overseas erection department for British Guiana Consolidated Goldfields, Ltd.; they will supply power for gold dredging operations.

"Underground" Track Rearrangement

The rearranged track layout between South Kensington and Gloucester Road stations came into use last week-end. The object is to eliminate delay at this point to both eastbound and westbound District Line services, and to afford combined platform facilities for eastbound District and Circle passengers at South Kensington and Gloucester Road. In addition to the trackwork, a centralised signalling control system has been introduced.

Trade Announcement

Mr. R. Aspinall, formerly employed in the Lighting Department of Benjamin Electric, Ltd., has joined the Lighting Department of the **A.E.I. Lamp & Lighting Co., Ltd.**, North-East Region, where he will be at regional headquarters in Leeds. Mr. K. T. Hackett has been appointed representative in the South Staffs area of the Midland region. He was previously Midlands representative for Pye Telecommunications, Ltd.

Annual Holidays

The Hepworth Iron Co., Ltd., is closing its works for the annual holidays from 9th to 26th August.

Atomic Power Developments

THIRD ANNUAL REPORT OF THE ATOMIC ENERGY AUTHORITY

THE third annual report of the United Kingdom Atomic Energy Authority, for the year ended 31st March last, shows that excellent progress was made over a wide front and that there was increased activity throughout the Authority's establishments. This necessitated considerable staff additions and by the end of the period under review the total number employed was over 27,000, representing an increase of 14 per cent compared with the previous year. There were several major developments in the United Kingdom's nuclear power programme, and increased attention was given to the application of nuclear energy to marine propulsion. Important steps were taken towards ensuring this country's future uranium supplies both for defence and civil uses.

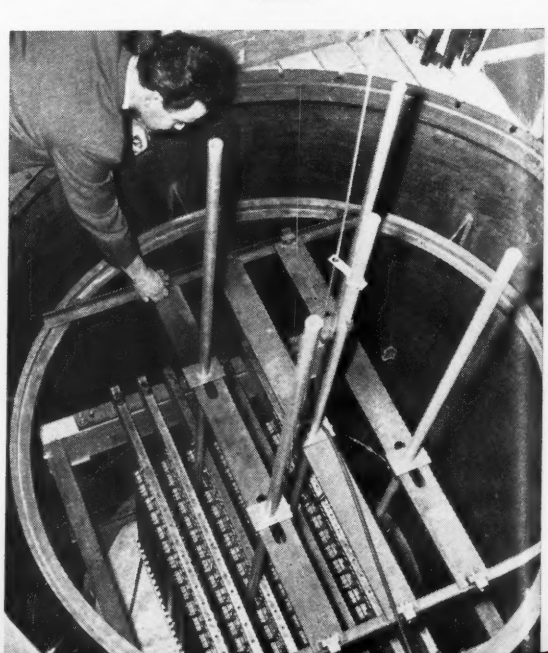
The most outstanding event of the year was the practical achievement of nuclear power by the opening of the Calder Hall station by the Queen on 17th October last. Generally, it can be said that the operating experience at Calder Hall has been satisfactory. The plant has gone into operation with less trouble than might reasonably have been expected, and it has worked reliably at the designed conditions of power level and temperature; these have indeed been exceeded with satisfactory results for appreciable periods. The second reactor of Calder Hall "A" was handed over for operation at the end of November and by 31st March this year the station had exported 107,825,000 kWh, almost entirely from the first reactor. The first reactor of the "B" station was structurally complete by the end of March and is now being fitted out with the many plant items required. At Chapelcross the past year has seen great advances in the construction work.

A few days before the opening of Calder Hall, tenders had been submitted to the Central Electricity Authority and the South of Scotland Electricity Board, and in December contracts were placed for the erection of the first two English nuclear power stations. Provisional arrangements were also announced for the construction of the first Scottish station and a possible third English one. On 5th March last the Minister of Power announced the revised nuclear power programme under which the amount of nuclear capacity to be in operation by the end of 1965 is to be raised from the "White Paper" bracket of 1,500-2,000 MW to 5,000-6,000 MW. A fifth industrial team (Atomic Power Constructions, Ltd.) was formed during the year.

Turning now to research and development, the primary objective of the Authority's programme is the development of reactors offering the prospect of producing the cheapest power possible for this country's nuclear power programme. The gas-cooled graphite-moderated reactor is likely to provide the basis of Britain's nuclear power programme for many years to come. The Authority believes that there are considerable possibilities of further

Seated at the table in the above photograph are, left to right: Mr. F. C. How (Lord President's Office), Sir Christopher Hinton (member for engineering and production), Sir John Cockcroft (member for scientific research), Sir Edwin Plowden (chairman of the Authority), Mr. E. H. Underwood (director of public relations), Sir Donald Perrott (member for finance and administration) and Mr. D. E. H. Pierson (secretary)

An engineer inserting a fission chamber into the mass of the graphite moderator stack of the NERO experimental low energy reactor at Harwell



developments of this type of reactor which should lead to substantial lowering of capital costs.

One objective is to increase the operating temperature of the fuel from 400 deg C to about 600 deg C. This would increase the thermal efficiency and allow the electrical output of a two-reactor station to be raised to about 800 MW. This would call for ceramic fuel elements instead of the present metallic elements, and for a canning material capable of withstanding the high temperatures. Uranium oxide ceramic fuel elements and beryllium canning are being developed for these purposes. It should also be feasible to re-design the reactor to make it suitable for smaller electrical outputs of the order of 30 MW. The reactor size (even using natural uranium) and capital cost would be appreciably less than at Calder Hall.

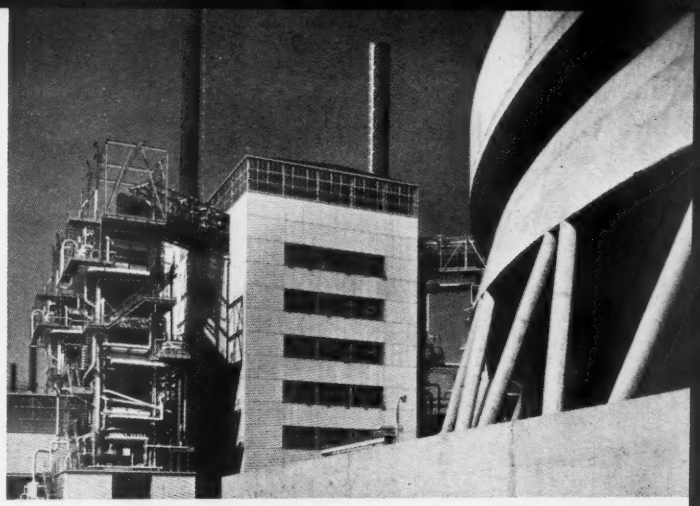
A zero-energy reactor, NERO, has been constructed to study the physics of advanced graphite-moderated reactors. This will provide information on both the sodium-cooled and gas-cooled systems. The use of liquid sodium would allow the amount of heat extracted from each ton of uranium to be increased several times over the early gas-cooled reactors. The advantages over the later types would be less and it is not yet known whether they would justify the building of a prototype.

The Dounreay fast-breeder reactor is expected to start operation in 1958. The zero-energy reactor ZEUS at Harwell has been used to study various designs for its core. The Dounreay reactor is essentially an experiment, which could lead to the construction of commercial fast reactors during the 1970's when substantial supplies of plutonium fuel become available from the civil power programme.

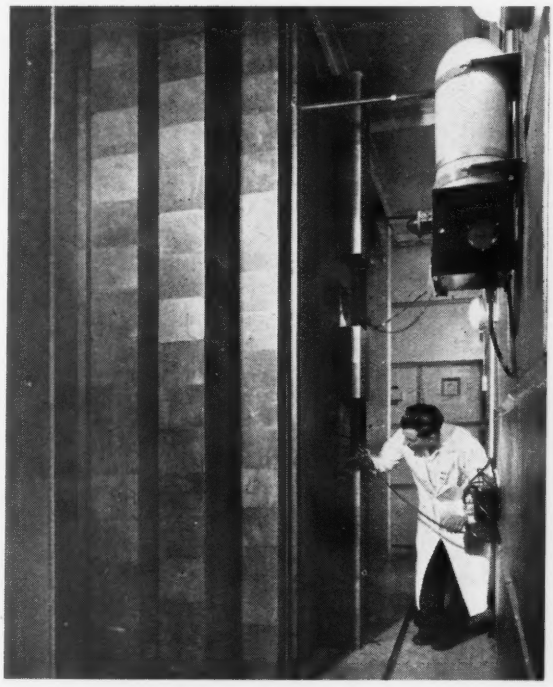
High priority is being given to the development of a thermal breeder reactor working on the uranium-233/thorium cycle (i.e. uranium-233 producing heat and transmuting thorium into a fresh supply of uranium-233 fuel). This would use a ceramic uncanned fuel able to withstand temperatures of the order of 800 deg C. It should be possible for a reactor experiment on this system (which promises high efficiencies and low fuel costs) to operate by 1960. The results of fuel tests in the BEPO and DIDO reactors at Harwell are encouraging. The uranium-233/thorium fuel cycle could also be used in an aqueous homogeneous (water solution) reactor. The uranium fuel would be dissolved in heavy water. Zero energy studies are proceeding on a facility known as ZETR. Liquid-metal fuels may be used in thermal breeder systems operating on the uranium-233/thorium fuel cycle or fast fission systems on the plutonium/uranium-238 cycle. One form is a core of uranium-233 fuel dissolved in liquid bismuth; this is surrounded by a thorium slurry.

The development of a pressurised-water reactor for the propulsion of submarines is, by agreement with the Authority, being undertaken by the Admiralty, who have placed development contracts with Vickers Nuclear Engineering, Ltd. (Vickers, Ltd., Rolls Royce, Ltd., and Foster Wheeler, Ltd.). The Authority is collaborating in certain aspects of the work. The LIDO "swimming pool" reactor at Harwell is being used for studies of shielding against radiation. The land-based prototype of the naval reactor will be built at Dounreay. The reactor will use enriched uranium fuel elements in a non-corroding alloy.

The Authority is represented on an Admiralty Committee for the study of the use of reactors in merchant



One of the Calder Hall reactors showing two of its associated heat exchangers



The nuclear properties of the marine propulsion reactor system are determined in an "approach to criticality" experiment such as the one at Harwell shown above

Right: General view of the Dounreay establishment where a fast fission breeder reactor is being built

ships. Large ships, which spend most of their time at sea, such as tankers, might be powered by a scaled-down version of the Calder Hall type of reactor. For smaller ships it will probably be necessary to develop a new type of reactor and two systems are being studied. An organic-liquid-moderated reactor might be built in small sizes to give outputs of the order of 20,000 s.h.p. or less. A heavy-water gas-cooled reactor is the second possibility. The Authority will decide during the present year which should have priority. An investigation into this subject is being carried out at Harwell by the Authority and the British Shipbuilding Research Association. It seems probable that a large part of the export demand for nuclear power would be for units of 30 MW or less. Power units of the type being considered for ship propulsion may prove to be suitable for this role.

Three new reactors were commissioned at Harwell during the year. Firstly, there was LIDO, a 100 kW "swimming-pool" reactor for research into shielding from radiation, and particularly in connection with the development of light-weight shields. It is also being used in connection with the naval reactor.

Secondly there was the 10 MW high-flux materials-testing reactor DIDO, which is cooled and moderated by heavy water. This will test samples of moderators, coolants and fuels for other reactors. Finally there was NERO, a zero-energy graphite-moderated reactor (gas- or liquid-metal-cooled). Work proceeded during the year on the two PLUTO materials-testing reactors at Harwell and Dounreay.

Although the greater part of Harwell's research is concerned with the technology of reactors and the processes associated with them, about a fifth of the effort has been devoted to fundamental research—research design to broaden knowledge about the bases of the sciences from which technology is developed. The aim is to ensure that, when new technical problems arise in project development, the fundamental scientific knowledge on which to base a solution is available.

Research has continued at Harwell into ways of obtaining power from controlled thermo-nuclear or fusion reactions. The objective is to heat isotopes of hydrogen to temperatures in the region of 100,000,000 deg C at which the nuclei fuse to form heavier nuclei, releasing energy in the process. The central problems to be solved are those of heating the hydrogen to the required temperature, and of isolating the hot gas from the walls of its container, and maintaining it at temperature long enough for the heat energy released in fusion to exceed that needed to heat the fuel. A major piece of experimental apparatus for investigating the processes involved has been designed and built in collaboration with an industrial firm. With this equipment, which is almost complete and should be in operation during the next few weeks, it is hoped to reach temperatures at which fusion reactions can be detected.

During the year collaboration on research into controlled thermo-nuclear reactions was established with the United States under the agreement for co-operation on the civil uses of atomic energy between the governments of the U.K. and the U.S.A. Several visits have been exchanged by parties of scientists from the two countries and the resulting interchange of ideas has been mutually beneficial.

Research in nuclear physics requires machines capable of accelerating charged particles over a very wide range of energies from a few hundred keV to thousands of MeV. One valuable machine at Harwell is the 4 MeV electrostatic generator.

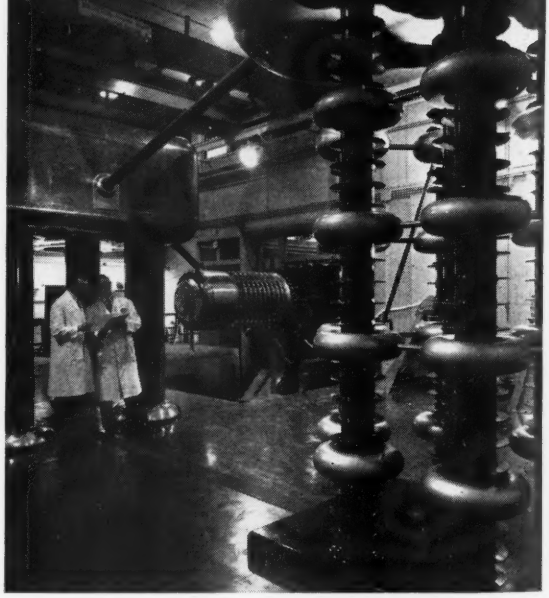
To extend research on nuclear structure, a new generator is being developed by the Research Group in collaboration with the Weapons Group (who are to have a similar machine) and an industrial firm. It will give particles of energies up to 12 MeV. A larger machine whose construction is well advanced is the 50 MeV proton linear accelerator. The first stage, which will accelerate protons up to 10 MeV, is almost complete. The later stages, being manufactured by an industrial firm, should be finished by the end of 1957.

Design is well advanced for a new type of proton synchrotron for an energy of 6,000-7,000 MeV. Protons would be accelerated to 15 MeV in an improved linear accelerator (based on the 50 MeV machine) and injected for the main part of the acceleration into a magnet ring of 120ft diameter and weighing 6,000 tons. If it is decided to build it, this machine will be one of the main tools of the National Institute for Research in Nuclear Science.

In discussing health and safety the report states that in the period under review there has been no single case of injury arising from radiation or the handling of radioactive substance, but there was one fatal accident from electric shock.

Sales of radioisotopes continued to increase during the year. The total value of sales was about £541,000 of which £154,000 was from the Isotope Division at Harwell and £387,000 from the Radiochemical Centre at Amersham. This total represents an increase of 12 per cent over the previous year.

There will be a substantial increase in the quantity of radio-isotopes produced by irradiation in nuclear reactors when the new high-flux reactors DIDO and PLUTO are brought into use for isotope production. In addition, the production of cobalt-60 in the Calder Hall reactors is being considered. Fission product caesium-137 is being separated in an experimental plant at Windscale and several large sources have been made. A certain



The Cockcroft-Walton h.v. generator with the 500 keV injector of the 50 MeV proton linear accelerator in the background

amount of strontium-90 has also been produced. The demand for these sources far outruns present production capacity and the Authority is considering the construction of a plant to produce very much larger quantities of caesium-137 and strontium-90.

The Reactor School at Harwell has continued to give training to suitably qualified students from industry on the science and engineering of nuclear power stations and their ancillary processes. Up to and including the first course in 1957, a total of 471 students passed through the school. In addition two short courses have been given to industrial executives with a technical background. A Reactor Operations School has been set up at Calder Hall, where students receive theoretical and practical instruction in the operation of the reactors. Students for the six weeks' course will be expected to have attended the Harwell Reactor School or to have reached a comparable standard of knowledge.

Over 900 students have passed through the Isotope School at Harwell since it opened in 1951. During the current year specialised courses have been held in radiological protection, autoradiography and the uses of radioisotopes in medicine. There are plans to increase the size and scope of the school.

Welding Research

NEW METALLURGICAL LABORATORY OPENED

LAST week the British Welding Research Association's new metallurgical laboratory was opened by Marshal of the Royal Air Force Lord Tedder, G.C.B., D.C.L., LL.D., at Abington Hall, near Cambridge. Provision is made for research on the welding of reactive metals and heat flow in welding. There are also well-equipped laboratories for chemical and gas analysis, metallographic examination, heat treatment and mechanical testing.

The welding laboratory contains a comprehensive range of equipment for the metal-arc and gas-shielded welding processes. Extensive use is made of automatic traversing units as these permit better control of welding conditions than can be obtained with manual welding. A specially designed instrument panel enables the welding variables to be measured and recorded automatically in an observation room from which the process of welding operations can be followed. The working area is divided into four principal bays so arranged that the centre two can be easily viewed from the window of the instrument room. Manual welding is normally carried out on a simple positioner table in front of the instrument room. In this location observation of welding can be made behind the tinted glass windows and instruments are housed in satisfactory conditions.

Power supply for the welding equipment is brought in by overhead busbar, and take-off points are provided on three stanchions in the centre of the floor area. Welding power sources include commercial transformers, transformer-rectifiers and motor-generator sets with capacities from 25 to 750 A. An experimental variable characteristic generator is also available and a 1,000 A battery supply is being installed.

Studies in Progress

The behaviour of welding arcs and the influence of electrical parameters on the metallurgical properties of the weld bead is a study of particular importance in dealing with the gas-shielded welding processes, which are undergoing rapid development. Work on arc characteristics is being carried out in co-operation with the Electrical Research Association. It has been shown for the aluminium self-adjusting arc that there exist three well-defined ranges of conditions: sub-threshold, normal and defective. The change from sub-threshold to normal is abrupt and is associated with a step in the burn-off-rate curve. Welds produced in the defective range contain large voids and oxide folds. The change from normal to defective ranges is not associated with any peculiarity in the burn-off curve and occurs in the region of 350 A welding current.

The occurrence of defective or puckered welds at over 350 A is a serious limitation in an otherwise satisfactory process for automatic operation. B.W.R.A. has shown that by controlling the ingress of air to the arc and weld pool at high currents, these defects may be overcome.

A special nozzle has been devised which provides extra protection to both the leading and trailing edges of the weld pool. Well-shaped, sound deposits have been made using this type of nozzle at welding currents up to 600 A. The nozzle was demonstrated welding 1in thick aluminium at 500 A.

In controlled tungsten-arc welding equipment the torch automatically follows an uneven contour in a work piece. The control is from the arc voltage through an electronically operated actuator, which raises or lowers the head to keep a constant arc length.

Research is in progress on the properties of welds made with carbon-dioxide shielding and on the influence of process variables on the behaviour of the arc and weld bead. Oscillographic studies of welds deposited under controlled conditions suggest that for mild steel wires there is a threshold current at nearly 400 A. This is being investigated further since, if definitely established, it will conflict with the generally held view that at no current is there a change from globular to spray-type transfer.

Electric Lifts

DETAILED recommendations for the construction of passenger, goods and service lifts are contained in a 52-page Standard which has just been published by the British Standards Institution. This comprehensive document is issued as B.S. 2655: Part 1. Dimensions for lift wells were recommended in Part 3 of this same Standard, published two years ago, while Part 2, which is still to come, will be concerned with the special requirements applying to the most commonly used type of lift motor.

The early publication of Part 1 was called for by lift manufacturers and users, and in order to meet this demand the Standard is issued in the form in which it was circulated to industry for comment. It is expected that a revised version will be published in the not too distant future to take into account any amendments which are necessary.

The Standard makes detailed recommendations on other aspects of lift construction. Safety requirements to prevent accidents to both passengers and maintenance workers are a prominent feature. An extensive list of evidence is included to obviate misunderstandings between users and manufacturers. The minimum structural requirements for passenger, goods and service lifts are set out in appendices.

Copies of this Standard may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 7s 6d net.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Mining Electrical Engineers

IN a leaderette in the *Electrical Review* of 28th June, reference was made to the Association of Mining Electrical and Mechanical Engineers, with the suggestion that within the framework of the Institution of Electrical Engineers there should be formed a separate section for mining-electrical engineers, whom you consider as possibly on a slightly higher level than radio-electrical engineers. Presumably, the other members of the A.M.E.M.E. who include, besides mining-mechanical and civil engineers, the much larger body of mining-electrical and mining-mechanical technicians, could then be pigeon-holed into little sections of other institutions and thereby tidy up the whole matter to the satisfaction of the *Electrical Review*.

No surely not! The Association of Mining Electrical and Mechanical Engineers has been established for nearly 50 years, and make no mistake about the matter, it is here to stay.

There is nothing to prevent those of our members so qualified from joining any of the Chartered Institutions if they so desire, and in fact many of them are members of such institutions. But the A.M.E.M.E. knows that the work of the highly specialised electrical, mechanical, and civil engineers connected with mining, is so closely integrated in day-to-day functions that it is essential to have an organisation where relevant matters are discussed for their mutual understanding, and that to have a separate organisation for each branch would be a retrograde step. No, our Association will not be split assunder, but will slowly but surely increase in magnitude until the granting of a Royal Charter will establish its status beyond further doubt.

Manchester, 2. J. E. RIDLEY,
President,
Association of Mining Electrical and Mechanical Engineers.

Measurement of Insulating Capacity

IN the *Electrical Review* of 28th June Mr. A. R. Nisser inquires whether there has been any research to devise an instrument capable of registering "the insulation reserve capacity" of insulation in service. This problem has been the subject of extensive investigations at the Electrical Research Association. However, deterioration and failure of insulation may be caused by several processes, which often occur independently and, in general, no single test can assess the probable life. Sensitive instruments have, however, been devised to detect conditions which cause deterioration.

Internal and surface discharges in insulation are a common cause of failure. An a.c. tuned circuit discharge detector has been designed to measure the magnitude of minute discharges in insulation of capacitance between 10 pF and 10 μF.[1] Oscillographic display assists in locating the origin of discharges. Some two hundred industrial laboratories now use a commercial model of this instrument, and tests are in progress to assess the life of insulation in the presence of discharges and the relative resistance of different materials to discharges.

A dispersion meter has also been designed [1, 2] to determine the presence of moisture in hygroscopic insulation, since absorbed water reduces the discharge inception voltage, or causes electrochemical or thermal breakdown. This instrument, which is available commercially, is simple to use and avoids some uncertainties inherent in insulation resistance tests. At temperatures between 20 and 90 deg C, correlation has been established between the dispersion factor, the loss angle at 50 c/s and the moisture content in S.R.B.P. insulation.[3] In this material and in oil impregnated paper,[4] there is evidence that the dispersion factor gives a more reliable guide than loss angle measurements.

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[2] Dispersion Meter, Model 2, Instruction Manual. V/T124, 1955.

[3] Smith, D. C. G. "The Relation between Dispersion and Moisture Content in Paper Insulation". E.R.A. Report Ref. V/T128, 1956.

[4] Grierson, R. A. "Transformer Impregnation". *Elect. J.* 1956, 156, p. 990.

Leatherhead. J. H. MASON.
Electrical Research Association.

The I.E.C. Meetings in Moscow

SUPPLEMENTING your Special Correspondent's report in the *Electrical Review* of 26th July on the I.E.C. meetings in Moscow, your readers may be interested in the following message which was given to Dr. P. Dunsheath, President of the I.E.C., by Mr. A. S. Pavlenko, Minister of Power Stations in the U.S.S.R., on the termination of the meeting in Moscow:—

"This visit of the I.E.C. to the U.S.S.R., the first in over half a century, has been a very happy experience for me and my colleagues. The discussions of delegates from many countries during the past two weeks has advanced world electrical science, and has stimulated electrical engineers in their work of international standardisation. It has greatly contributed to the cause of strengthening the spirit of friendship between nations.

"I am delighted that your conference has been such a success, and I give you my best wishes for the continued progress of the I.E.C."

London, W.1. J. F. STANLEY,
Secretary,
British National Committee, I.E.C.

Iron and Steel Institute Meeting

THE Iron and Steel Institute is holding a special meeting in Belgium and Luxembourg from 18th to 28th June, 1958, and in honour of the Institute's visit, the Centre National de Recherches Metallurgiques, the Groupement des Industries Siderurgiques Luxembourgeoises, and the Groupement des Hauts Fourneaux et Acieries Belges are organising an international iron and steel meeting on the general theme of "New Developments in Iron and Steelmaking." While the full programme of the meeting, which will include technical sessions, works visits, and social functions, will be announced later, a provisional programme has been prepared for the technical sessions which include one on large arc furnaces on Thursday, 19th June.

Induction Motor Protection

ARRANGEMENTS FOR THREE-PHASE MACHINES

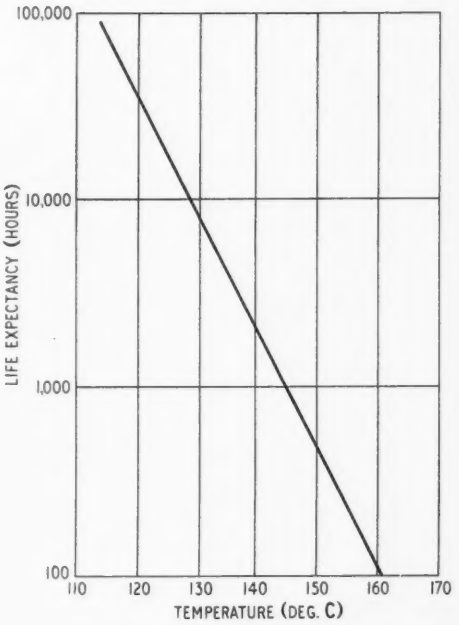
By J. H. TOULE, B.Sc., A.M.I.E.E.

THE purpose of fitting protective relays to three-phase motor circuits is twofold. On the one hand it is to prevent a motor from being damaged under abnormal operating conditions, and on the other to disconnect an already damaged motor from the supply. Overcurrent and single-phasing protection are provided to prevent injury to the motor due, in the main, to overheating of the insulation. Secondary effects, such as the throwing of solder on the cage end rings, may also be involved. In some vital applications where the loss of the motor drive is much more serious than the loss of the motor, such forms of protection are sometimes omitted.

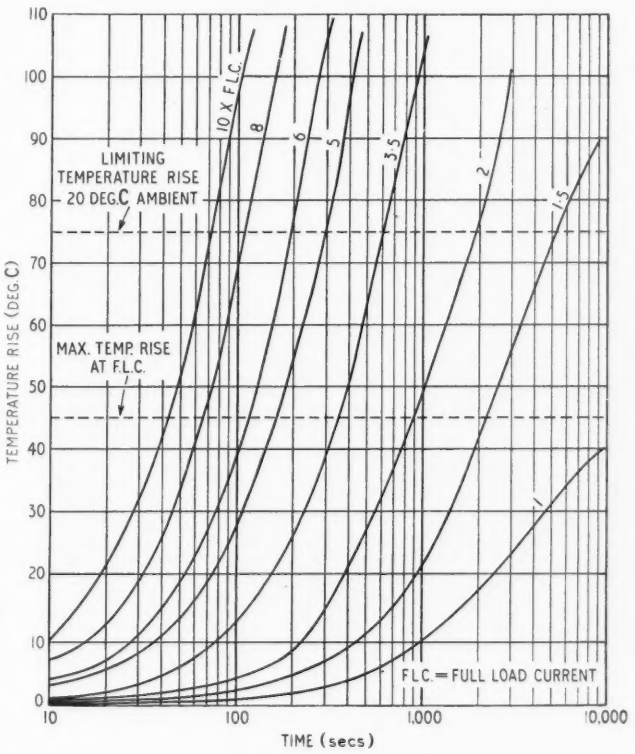
Lack of confidence in the protection may be due to bad application or incorrect adjustment of otherwise good protection. In such cases, the protection may trip out the motor at values of insulation temperature well below the safe maximum, and the user may consider himself better off without such protection.

The second class of protection, which is fault clearance, cannot be dispensed with under any circumstances. The consequence of short circuits and flashovers are such that the equipment must be disconnected from the supply immediately. Damage to the machine cannot be avoided under these conditions. The aim is to prevent further dislocation to the system.

In accordance with B.S. 2613:1955 a motor wound with Class A insulation must deliver its rated output without the windings hot spot exceeding a temperature rise of 55 deg C. It must also be capable of 25 per cent overload continuously. The principal factor limiting overload capability in a motor is winding temperature rise and the protection must be designed to keep this within safe limits. If the safe maximum temperature is exceeded, the life of the winding insulation will be reduced and premature failure may occur.



Above: Fig. 1.—Life expectation of Class A insulation



Left: Fig. 2.—Average temperature rise in the stator windings of 12½ h.p. totally enclosed motor A

Fig. 1 shows the relation between life expectancy and temperature for Class A insulation. Normally, 105 deg C is taken as the safe maximum for Class A insulation. Class B is satisfactory up to 130 deg C whilst the new Class H (silicone) insulation will withstand 250 deg C. Figs. 2 and 3 illustrate the overload capabilities of two different types of motor related to average winding temperature rises. Since hot spot temperature will fix the limit, a diversity at 10 deg C between this and average temperature is estimated. Assuming a maximum ambient temperature of 20 deg C, a rise of 75 deg C will give the permissible maximum of 20+10+75= 105 deg C. This is indicated by the upper horizontal dotted line on Figs. 2 and 3. The

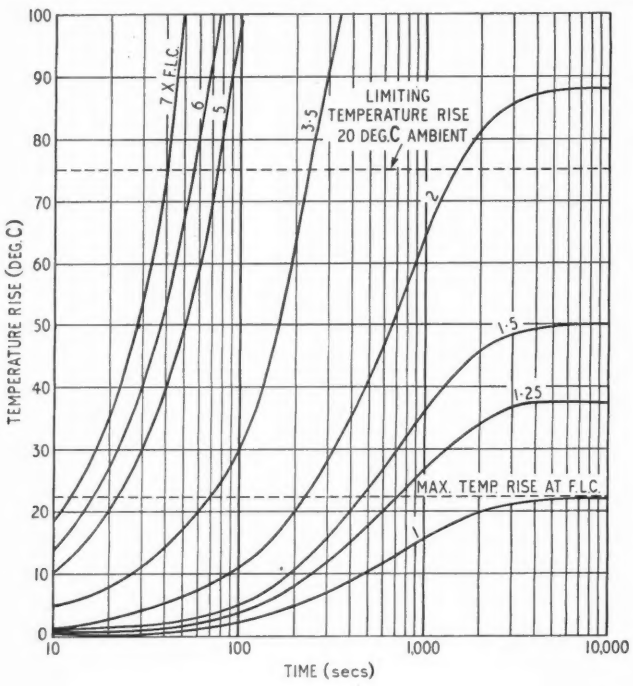
time values at which individual overcurrent curves cut the dotted line set the limiting requirements for the overcurrent protection. The resulting curves have been drawn dotted on Fig. 4. It must be stressed that these dotted curves refer to a motor starting from " cold," the ambient temperature being 20 deg C.

Early types of overcurrent releases consisted of solenoids fitted with dashpots to prevent unwanted operation during starting surges. Fig. 5 shows in cross section a modern version of this device. The operating solenoid is connected in series with the motor supply and creates a pull on the iron plunger in proportion to the load current. When the pull exceeds the plunger weight, the plunger is drawn up into the solenoid and operates a pair of tripping contacts. By adjusting the position of the plunger within the solenoid, the operating current value may be varied. Normally, this is done by screwing the oil reservoir up or down. A time lag characteristic is effected by an oil-immersed piston attached to the lower end of the plunger. By means of a flap valve and bleed hole, the resetting time of the dashpot may be reduced to a few seconds.

The dashpot controlled tripping device has very variable characteristics and this is its main disadvantage. Fig. 4 illustrates how the operating time of a given dashpot can vary between temperature limits. This is caused by the viscosity/temperature characteristic of the oil used. Some improvement can be effected by using silicone oils of fairly constant viscosity as shown in Fig. 6. Even so, results vary between individual equipments as slight variations in the dashpot piston clearance can double the operating time at a particular load.

The bimetal thermal device shown in Fig. 7 has more constant characteristics and, if well made, can be quite satisfactory. The tripping time of a thermal release depends on a number of physical conditions such as heat distribution and bimetal deflection for a given load. In a mass produced element such variations sometimes make the thermal release more inconsistent than the dashpot. Ageing of the bimetal is another factor having the same effect. A bimetal thermal relay may be installed and set to trip at 25 per cent overload: three months following, it may trip out the motor at less than full load.

In the U.S.A., induction type relays are quite commonly used for overload protection. It is possible to produce an induction relay having an inverse time characteristic closely following the limiting motor characteristic as in Fig. 4. They are not popular in this country for two



Above: Fig. 3.—Average temperature rise in stator windings of 120 h.p. ventilated motor B

Right: Fig. 4.—Time/current curves for three-phase motor protective devices

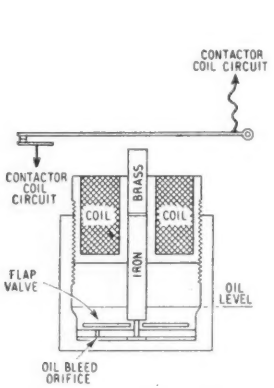
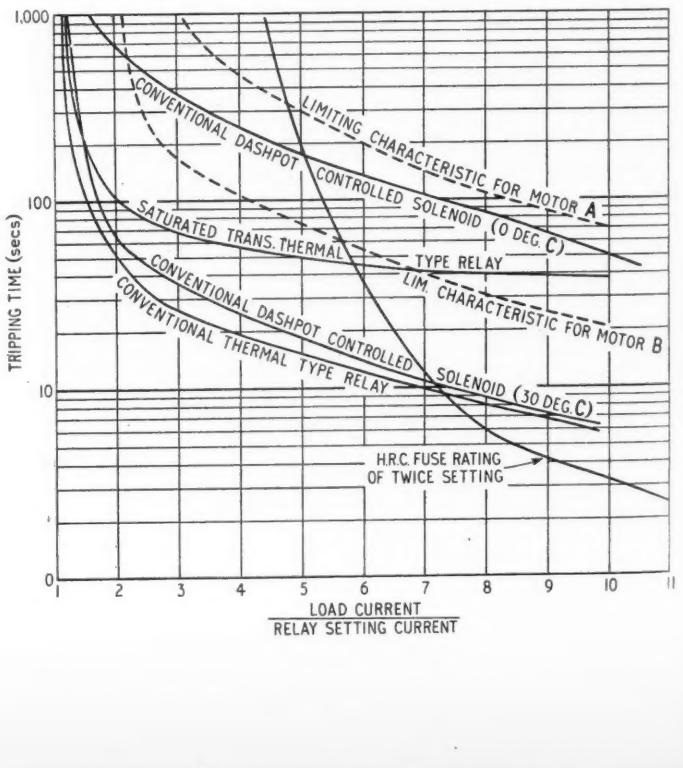
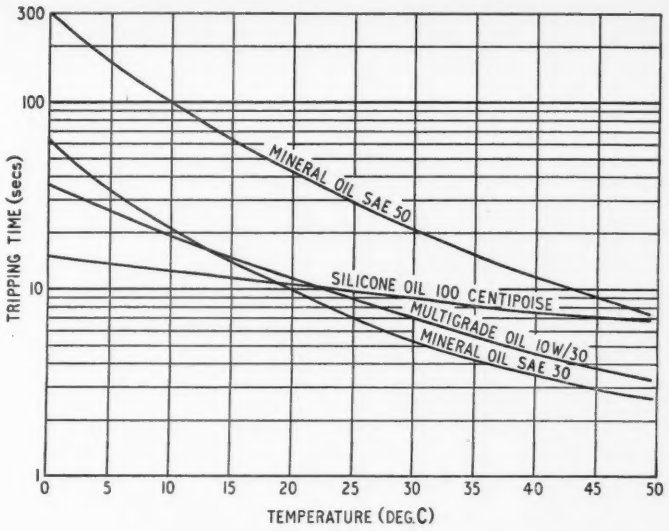


Fig. 5.—Dashpot controlled solenoid tripping device



Right: Fig. 6.—Variation of dashpot tripping times with temperature at 5 times setting current



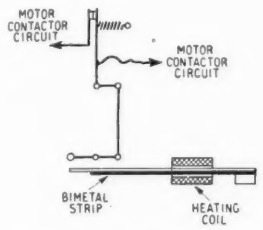


Fig. 7.—Bimetal thermal element

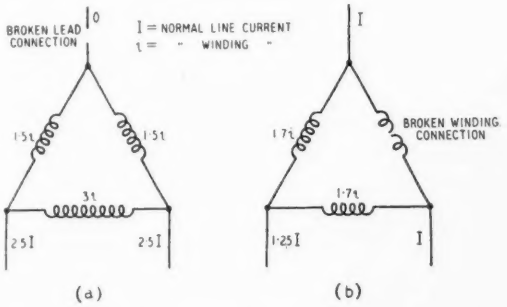


Fig. 8.—Conditions in delta connected motor for single-phasing

reasons. Firstly, induction relays are not particularly robust and, secondly, they have an indefinite starting current for small overloads.

Overload settings are frequently much too light with the consequent risk of tripping out a motor unnecessarily. There should be no need to use a setting of less than 125 per cent. B.S. 2613:1955 allows a 25 per cent overload continuously. Many motors of the ventilated type will withstand much higher overloads without overheating. Fig. 3 indicates that at an ambient temperature of 15 deg C, motor "B" should withstand twice full load current indefinitely without exceeding an average winding temperature of 105 deg C.

A hot spot temperature of around 115 deg C would be involved which would reduce the life of the motor to 8½ years' continuous running. It does indicate that some motors will withstand considerably more overload than is generally tolerated. Unfortunately, modern motors are designed to the limit and vary considerably in overload capabilities. Manufacturers are reluctant to make any guarantees in this respect and therefore a large factor of safety is employed in relay settings.

A common cause of overheating in three-phase motors is single-phasing. Fig. 8 shows the change in line and winding currents for different single-phasing conditions. It is obvious from the diagram that the percentage increase of current in the windings is much greater than that in the supply leads. The protective relay only reacts to the increase in the supply, and will not see the overcurrent conditions as they exist in the windings. For instance, Fig. 8 (a) indicates an increase of 200 per cent in one winding for 150 per cent in the relay. The condition shown in Fig. 8 (b) is even worse; here, an increase of 70 per cent in one winding reflects only 25 per cent in the protective relay. If the protective device is set to allow a 25 per cent overload, the 70 per cent overload on the winding would persist and overheating would occur.

Such single-phasing conditions are adequately dealt with by the differential type thermal relay illustrated in Fig. 9. The well-known P. & B. Golds relay uses this principle and formerly had an out-of-balance setting of 7 per cent. This has since been increased to 12 per cent. With balanced overloads, the three elements move together and the relative distance between the single-phasing contacts is unaltered. A separate overload contact is used giving an overload adjustment quite independent of the single-phase setting. These relays are precision made and have a contact travel much greater than the conventional bimetal thermal trip. In addition, the bimetal elements are in the form of a spiral which gives a considerable length of unrestrained bimetal operating at a low temperature. This gives the P. & B. Golds relay a high accuracy setting which does not vary.

The high sensitivity of the differential thermal relay to out-of-balance currents may be a disadvantage. It can be shown that a given value of out-of-balance voltage

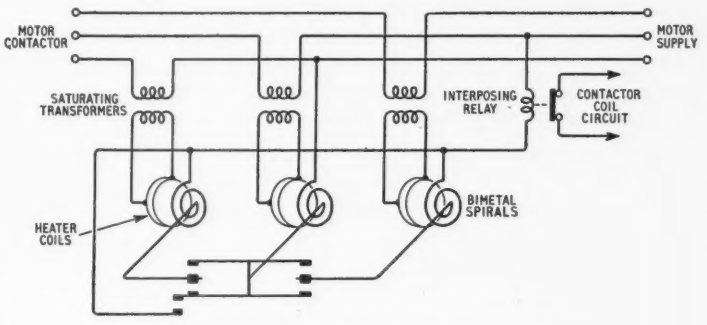


Fig. 9.—Principle of differential saturating thermal relay

applied to a three-phase induction motor will cause an out-of-balance current of about six times the magnitude. Consequently, a very small out-of-balance voltage may cause the relay to trip on out-of-balance current if allowed to persist. In a supply system, faulty circuit-breaker contacts, for instance, may well give rise to this condition until detected. For this reason, the Central Electricity Authority insists on an out-of-balance setting of not less than 12 per cent for differential thermal relays. This figure is still well below the 25 per cent setting required to deal with the single-phasing fault of Fig. 8 (b).

Unbalanced currents due to unbalanced supply voltages or to other causes such as an open circuit in one phase can be resolved in a positive phase sequence balanced current component which operates the motor and negative phase sequence balanced component which sets up a magnetic field rotating in the opposite direction to the rotor. This rotating field can cause serious overheating of the rotor and is one of the reasons why a comparatively low setting of phase unbalance in the protective relay is desirable.

Stalling is by far the most difficult condition to cater for in motor protection. A three-phase induction motor takes 5 to 7 times its normal full load current at standstill and its rate of heat dissipation is about half the full speed value. The rate of winding temperature rise depends almost entirely on the thermal capacity of the copper and the maximum safe temperature will be reached in a minute or so depending on the type of motor. Fig. 10 shows the temperature rise rates for various types and sizes of machines.

The protection problem is complicated in cases where long starting times are unavoidable and direct-on-line starting is used. Motors driving heavy fans may take as long as 60 sec to reach full speed. If the protective device is designed to allow this time at stalling currents, the setting may be too great for small overloads of say, 1·5× full load. Conversely, if the small overload setting is correct, the starting time may be limited. Referring to Fig. 4 the time permitted by the dashpot and bimetal thermal overload types is only 12 to 14 sec at 6× full load current. On the other hand, the time for the P. & B. saturated transformer thermal relay is 45 sec at this overload. This figure is obtained without undue increase in tripping time at nominal overloads.

Repeated attempts at starting a stalled motor are often the cause of winding failure in spite of protection. A dashpot device will reset almost immediately after a trip and permit the operator to switch on the stalling current for a further period. Thermal devices must cool down before a restart can be attempted. Unfortunately, thermal elements have a much smaller heat capacity than the motor windings and will return to normal temperature whilst the windings may drop only a few degrees. Figs. 11a and 11b illustrate this point and show how excessive temperatures may result from repeated attempts at restarting.

To guard against this malpractice, special stalling relays have been produced. Such a relay is only in circuit during the starting period and will lock-out after a trip to prevent a restart. This ensures that the cause of the stall will be investigated before resetting the relay for normal starting. Sometimes one attempted restart is permitted before final lock-out.

No protective device can prevent an electrical fault. The function of fault protection is to safeguard against fire and explosion by disconnecting the faulty motor in the shortest possible time.

The majority of motor electrical faults consist

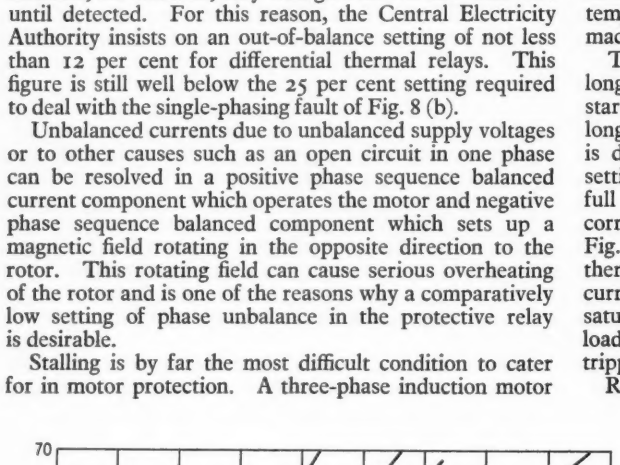

TEMPERATURE RISE (DEG.C)
TIME (secs)
12·5 H.P. MOTOR 4·5 x F.L.C.
15 H.P. MOTOR 7·8 x F.L.C.
35 H.P. MOTOR 5·9 x F.L.C.
15 H.P. MOTOR 2·6 x F.L.C.
¼ H.P. MOTOR 3 x F.L.C.

Fig. 10.—Temperature rise for stalled conditions

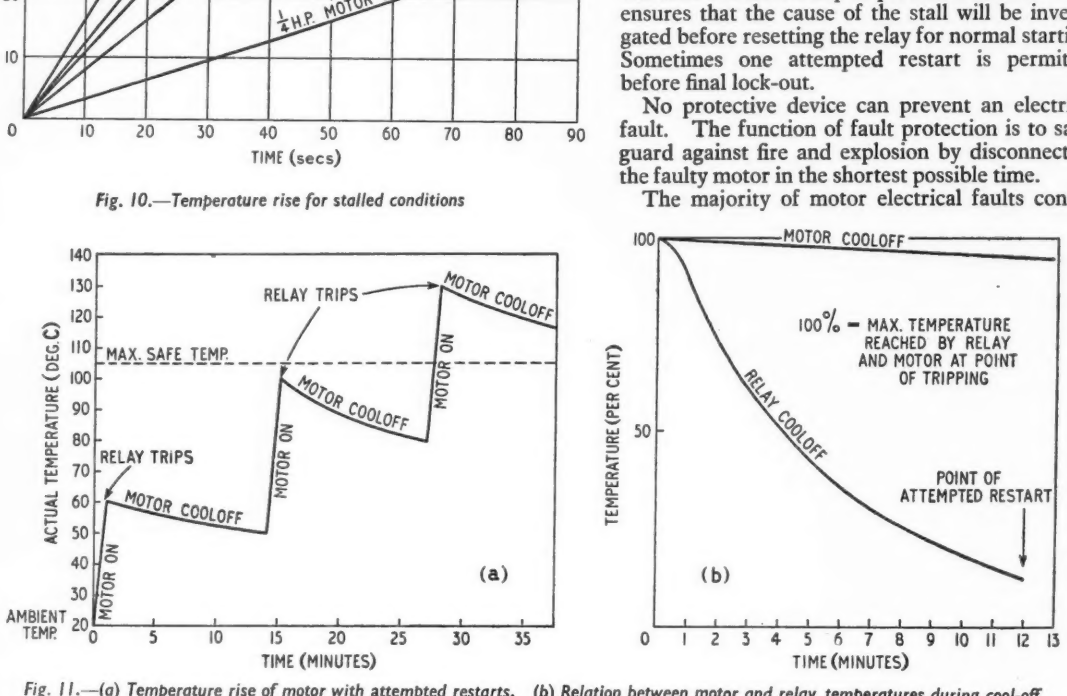


Fig. 11.—(a) Temperature rise of motor with attempted restarts. (b) Relation between motor and relay temperatures during cool-off after unsuccessful start

of flashover to earth and phase to phase faults; shorted turns make up the remainder. Shorted turns will not cause sufficient out-of-balance current to operate the protection in time. For example, one shorted turn can cause the current to be increased in that turn by 300 per cent for a 20 per cent increase in the line. Obviously, local overheating will occur and an earth fault will develop before the fault protection can disconnect the faulty motor.

For low and medium voltage motors, adequate protection is given by h.r.c. fuses. The potential fault current may vary between 20 and 300 times full load rating and clearance will be given in a fraction of a second. Fuses have an additional property of clearing a fault before the current maximum is reached on the first half-cycle. Relays are used to protect the higher voltage machines. A negative phase sequence relay will cater for all faults other than three-phase. It is unaffected by normal overloads and starting currents; this means that a sensitive setting may be used.

To-day, instantaneous overcurrent and earth fault relays are almost universally employed as in Fig. 12. The overcurrent relay must be given a setting greater than the motor starting current to prevent unwanted operation. Since the fault current is likely to be at least three times the starting current, this is no disadvantage. An earth fault relay connected as in Fig. 12 can be given a setting down to 10 per cent of the motor full load current. It may be necessary to use a stabilising resistance, otherwise transient unbalance of the c.t.s during starting may cause unnecessary operation. For this reason, and as stated above, three overcurrent units are often preferred.

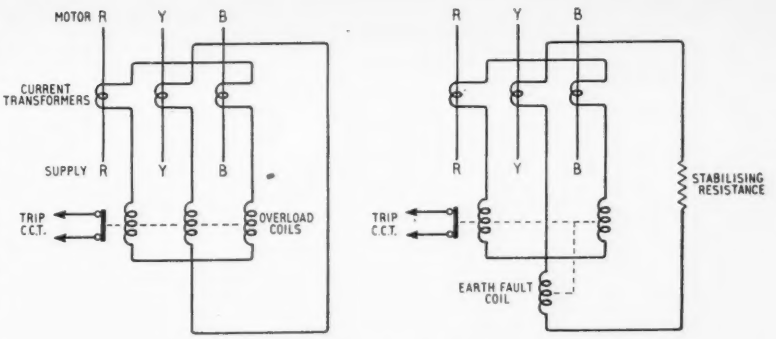


Fig. 12.—Three-overload trip. Two-overload trip

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IRON AND STEEL NEEDS

FORECASTS of the future demand for iron and steel and plans for meeting them are presented in a special report produced by the Iron and Steel Board ("Development in the Iron and Steel Industry," H.M. Stationery Office, price 4s 6d). It is estimated that by 1962 the annual demand for steel is likely to be 29 million ingot tons, of which 5 million will be exported, and productive capacity for that amount will be needed. Development proposals already approved by the Board will raise the capacity to 28 million tons by 1962 and other proposals will provide for the balance.

There are, however, said to be uncertainties surrounding some of the proposed developments. The proposals not yet finally determined include major developments by Richard Thomas & Baldwins, Ltd. In addition to their existing works at Ebbw Vale (Monmouthshire) and Redbourn (Lincolnshire) these proposals include a new iron and steel works at Newport, Mon., to make semi-finished steel. In certain circumstances these developments might be accompanied by the closing of obsolete capacity elsewhere. The company's proposals and their implication on the general pattern of development are still under discussion. While it may be that the new works would at some stage be enlarged to include a continuous hot strip mill and the complementary finishing equipment to make sheet and tinplate, it has not been decided when or where this development should take place.

Reference is made to the increasing competition by the principal steel-making countries for iron ore. Although the situation may be eased in the middle nineteen sixties by overseas orefield developments, the Board believes that still further exploitation of the English orefields is essential to the economic development of the industry after 1962.

There is a clear need for further modern capacity for the production of semi-finished steel. In most cases supplies of finished steel products should be adequate to meet the estimated demand in 1962 although there will rarely be much margin. At some stage it will be necessary to construct a new hot strip mill with the complementary iron and steel plant and cold rolling facilities for the manufacture of sheet and tinplate, but there is a divergence of view as to when this should be undertaken. The Board's view is that it should be included in the current programme.

Projects already approved with others still under consideration are expected to involve a total expenditure of £600 million up to the end of 1961—apart from any requirements for additional working capital—and the report discusses the financial and physical problems raised.

In a survey of technical developments it is shown that by far the largest proportion of steel (87 per cent) is produced by open hearth furnaces; only 6 per cent is made by the electric process. Mentioning the tendency towards bigger units, the report says that several of the new ore furnaces will be of 60 to 80 tons capacity.

The next ten years will see a high proportion of the country's plate-making capacity rebuilt and extended with modern 4-high mills which will give a better-quality product. Re-rolling is likely to become more closely integrated with the earlier stages of steel manufacture.

It is thought to be improbable that any large-scale application of nuclear energy in the iron and steel industry will be practicable in the near future, except through nuclear-generated electricity, because most processes require higher temperatures—well over 1,000 deg C—than present nuclear reactors can provide.

OVERSEAS ELECTRICAL TRADE

ELECTRICAL EXPORTS FOR THE FIRST HALF OF 1957

WITH the publication of the Board of Trade returns for June and the figures for the first six months of this year, the trend of British electrical exports can be seen. Although there has been some fluctuation from month to month in the value of exports of the various classes of electrical goods, taking the six months as a whole there has been an increase as compared with the first six months of 1956 in which all the main categories, except one, have shared. In the generating sets and motors group the increase over the six months was about £400,000, radio apparatus showed an advance of over £1,000,000, telegraph and telephone material improved by nearly £1,900,000, and electric cables and wires by over £1,000,000. The exception was the convertors, transformers, switchgear, etc., group which showed a fall of a little under £700,000.

Of the total of £3,420,986 of generating plant exported in June, Australia was the principal purchaser

TABLE I.—ELECTRICAL EXPORTS

Class	Month ended 30th June 1957	Six months ended 30th June 1956	Six months ended 30th June 1957
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	131,959	834,259	903,418
Ditto, 10 to 65 kW	113,460	747,847	959,189
Ditto, 65 to 200 kW	214,491	924,602	762,021
Ditto, over 200 kW	751,095	1,784,216	2,101,587
Spark ignition engine driven	24,190	214,749	105,388
Steam turbine driven	8,185	354,075	263,431
Hydraulic turbine driven	—	51,786	—
Other prime mover driven	27,413	435,639	178,508
Generators, not exceeding 200 kW	150,785	766,792	938,328
Ditto, over 200 kW	222,332	497,571	652,376
Parts of generators	413,231	3,427,304	2,380,776
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	173,528	1,245,760	1,178,039
Over ½ but under 1 h.p.	39,984	363,261	278,354
1 h.p. to 250 h.p.	418,161	2,532,099	2,919,753
Over 250 h.p.	172,207	447,414	706,344
Railway, tramway and trolley-bus motors complete and parts of all motors	302,796	999,197	1,203,189
Motor starting and controlling gear	257,169	1,399,774	1,895,100
	3,420,986	17,026,345	17,425,801
Converting machinery	16,283	218,461	365,135
Mercury-arc rectifiers	176,341	408,432	501,845
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	608,672	6,430,671	3,879,182
Over 7,500 kVA	344,481		1,272,374
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	349,806	1,644,816	1,958,746
Ditto, other	1,311,103	7,032,236	7,091,731
	2,806,686	15,734,616	15,069,013
Primary batteries:			
Lighting	73,968	481,463	595,406
Radio	226,821	1,456,211	1,600,465
Other	35,981	261,684	245,722
Parts (excl. carbons)	51,257	232,874	325,247
Lamps:			
Filament, exceeding 28 V*	93,417	602,605	553,428
Ditto, under 28 V*	25,800	173,881	184,432
Arc lamps and searchlights	14,637	124,999	85,264
Discharge lamps, fluorescent tubes, etc.	75,129	413,922	552,044
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	16,776	166,988	138,582
All other	341,627	1,317,049	1,781,296
Parts (excluding glass bulbs)	9,919	68,045	71,147
Radio and television transmitters	103,422	475,072	411,493
Commercial radio and radar equipment	1,180,871	7,402,955	7,455,936
Domestic radio receivers, mains	96,514	858,927	676,543
Ditto, battery	47,681	479,255	352,864
Ditto, other (incl. car)	28,423	153,537	165,854
Radiograms	33,365	222,811	167,178
Television sets	61,588	245,193	365,346
Public address equipment	91,670	543,169	572,148
Other radio and television apparatus, n.e.s.	31,784	193,786	279,016
Components and parts, n.e.s.	869,622	4,050,354	4,799,062
	2,913,262	16,177,141	17,236,465
Telegraph and telephone installations	840,646	3,775,971	4,196,279
Telephone instruments, separately consigned	194,708	730,443	975,153
Telegraph and telephone parts	772,193	3,610,546	4,914,347
Line apparatus for long distance commun.	308,636	1,054,056	963,572
	2,116,183	9,171,016	11,049,351

Class	Month ended 30th June 1957	Six months ended 30th June 1956	Six months ended 30th June 1957
	£	£	£
Cookers	71,452	510,898	403,830
Toasters	22,855	129,150	112,536
Other cooking apparatus	30,180	220,937	188,873
Parts and accessories	66,333	514,246	426,291
Space heating appliances	25,673	250,629	203,043
Water heating appliances	30,509	205,400	196,960
Other heating appliances	26,886	243,556	230,725
Parts and accessories	37,756	387,115	345,044
Irons	70,751	618,333	411,256
Arc welding equipment, a.c.	43,799	332,833	328,853
Ditto, d.c.	18,017	292,218	284,880
Resistance welding equipment	19,080	120,665	137,805
Electric furnace plant	81,639	330,125	554,152
Magnetos, ignition	15,991	190,280	175,792
Sparking plugs	159,128	980,006	966,598
Elec. appliances for aeroplanes, n.e.s.	228,812	1,240,986	1,608,507
Ditto, for motor vehicles, n.e.s.	377,894	2,169,189	2,189,937
Ditto, for cycles, n.e.s.	51,401	424,895	348,514
Signalling app. (incl. traffic signals)	139,125	379,079	715,792
Instruments, commercial	156,304	1,075,354	1,087,858
House service meters (including parts)	102,684	1,042,230	885,109
Electro-medical apparatus (not X-ray)	32,014	211,317	246,564
X-ray apparatus (excl. tubes and valves)	56,319	400,338	420,632
Vacuum tubes	33,362	156,673	272,675
Ceiling fans, complete	183,697	669,298	773,894
Desk fans, complete and parts of desk and ceiling fans	55,439	210,881	233,299
Vacuum cleaners	121,825	823,643	907,784
Floor polishers	79,390	463,163	507,868
Food mixers	41,522	389,154	273,793
Hair clippers and dry shavers	68,420	412,058	501,898
Other portable appliances	22,860	193,528	166,886
Parts	182,832	720,240	842,407
Portable elec. tools (not saws) and parts	202,617	1,235,660	1,322,460
Cables and wires:			
Telegraph and telephone, submarine	62,234	1,398,600	2,299,659
Ditto, other	911,224	4,990,156	5,885,859
Cotton, silk or art. silk insulated	46,415	368,172	229,037
Enamel, glass or asbestos insulated	101,016	572,654	601,636
Paper insulated	647,127	5,866,911	4,936,924
Rubber insulated	531,357	3,124,561	3,400,969
Thermoplastic insulated	227,350	841,057	1,100,952
Other	274,896	1,396,429	1,207,338
	2,801,619	18,558,540	19,662,374
Accumulators for motor vehicles	150,060	1,042,313	910,981
Ditto, traction	23,713	130,115	169,933
Ditto, radio and other portable	71,346	519,690	486,272
Ditto, other	23,277	452,190	187,511
Parts and accessories	97,202	530,418	511,937
Elec. porcelain, etc. (incl. insulators), n.e.s.	122,511	654,425	678,836
Insulating cloth and tape	50,204	351,977	361,575
Other insulating material	105,216	608,983	569,398
Permanent magnets	40,664	277,639	275,317
Radio, telegraph and telephone testing equipment, n.e.s.	67,459	240,975	401,908
Scientific elec. instruments (not telegraphic or telephonic):			
Time recorders and time switches, complete	7,271	75,557	69,627
Other	249,219	1,186,136	1,769,717
Electrical machinery, n.e.s.	90,699	732,904	454,084
Electrical apparatus and appliances, n.e.s.	961,439	4,687,650	5,578,313
TOTAL	19,572,592	109,450,346	115,282,436

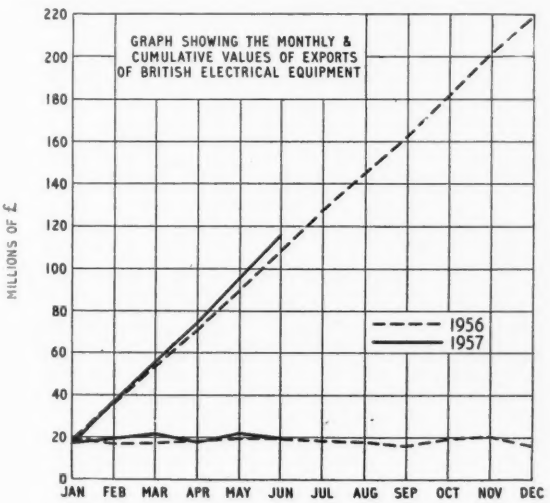
* The figures for 1957 are not completely comparable with those for previous years.

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	June, 1957	Six months ended June, 1956	Six months ended June, 1957	Country	June, 1957	Six months ended June, 1956	Six months ended June, 1957
	£	£	£		£	£	£
Channel Islands	91,569	449,561	531,739	Western Germany	91,417	1,047,290	1,172,944
Gibraltar	46,526	254,755	111,815	Netherlands	664,333	3,668,708	4,185,471
Malta and Gozo	34,604	381,053	346,882	Belgium	268,324	1,699,038	1,949,654
Cyprus	110,838	896,079	776,540	France	418,842	1,877,091	2,355,234
Sierra Leone	39,338	150,887	212,186	Switzerland	121,511	597,668	731,690
Gold Coast	166,156	891,361	1,104,238	Portugal	302,852	1,056,052	1,586,099
Nigeria	234,320	1,763,601	1,687,850	Spain	441,082	2,008,407	2,267,178
Union of South Africa	1,555,103	7,760,851	8,874,326	Italy	243,311	1,762,811	1,847,965
Rhodesia and Nyasaland	576,779	3,209,835	3,033,245	Austria	68,571	221,351	242,143
Tanganyika	48,684	321,533	360,483	Yugoslavia	31,745	345,744	278,903
Kenya	231,203	1,367,430	1,563,244	Greece	225,054	1,360,311	871,184
Uganda	41,898	455,329	610,934	Turkey	91,460	452,141	326,643
Mauritius	11,064	152,366	194,993	Belgian Congo	48,866	173,401	281,704
Aden	25,851	310,431	279,413	Portuguese East Africa	23,464	135,754	176,598
Bahrain, Qatar and Trucial States	170,036	558,483	917,535	Egypt	12,664	1,093,970	14,488
Kuwait	361,631	725,495	1,629,594	Libya	34,803	123,406	223,891
India	1,969,928	10,682,470	12,452,715	Southern Morocco	32,681	269,246	215,618
Pakistan	255,651	1,697,042	1,727,430	Sudan	180,041	510,674	661,747
Singapore	471,871	1,788,229	2,186,883	Syria	19,180	359,058	203,854
Federation of Malaya	233,645	1,613,435	1,787,538	Lebanon	32,238	302,832	209,120
Ceylon	111,578	950,804	809,344	Israel	39,765	550,658	419,513
British North Borneo	42,341	146,872	157,934	Jordan	13,989	334,410	387,982
Sarawak	35,776	111,266	163,478	Saudi Arabia	48,050	671,848	333,243
Hong Kong	293,718	1,206,540	1,407,092	Iraq	284,362	2,091,863	1,547,426
Australia	1,995,632	10,952,029	10,091,522	Iran	260,286	1,117,976	2,049,932
New Zealand	757,570	5,413,868	5,391,101	Burma	127,756	785,392	470,438
Fiji	11,010	99,110	109,558	Thailand	72,605	622,450	554,280
Canada	1,152,230	6,491,239	6,391,871	Indonesia	69,580	327,211	340,619
Jamaica	112,536	684,880	581,341	Japan	112,444	394,172	515,977
Barbados	21,073	158,272	116,884	United States of America	725,079	5,099,076	6,366,481
Trinidad	94,567	680,198	714,822	Cuba	42,077	208,023	255,125
British Guiana	24,239	237,317	236,223	Mexico	50,639	389,209	314,170
Other Commonwealth countries	117,018	542,042	644,634	Colombia	150,359	491,609	384,369
Irish Republic	237,216	1,825,884	1,342,396	Venezuela	136,539	1,787,995	1,602,147
Soviet Union	328,131	1,479,760	1,167,396	Peru	62,544	305,146	369,036
Finland	224,948	892,205	852,740	Chile	32,192	168,946	250,769
Sweden	400,242	1,911,928	2,221,750	Brazil	120,072	1,323,909	583,702
Norway	272,070	1,320,660	1,282,683	Uruguay	25,968	62,073	128,038
Iceland	3,977	92,582	95,929	Argentine Republic	201,549	390,062	671,601
Denmark	184,452	1,047,622	1,231,530	Other foreign countries	437,328	1,420,264	2,230,627
Poland	109,951	167,797	305,022				
				TOTAL	19,572,592	109,450,346	115,282,436

with a total of £461,165. Second place was held by South Africa with purchases of £306,406, and third by India with £284,291. Outside the Commonwealth notable markets were Spain (£282,688) and the Soviet Union (£198,315). The best market for converting machinery, etc., was India which took equipment valued at £475,568, Australia being second with £403,301 and Canada third with £351,166.

In the radio apparatus group, the leading purchasers were France with a total of £229,442 and the Netherlands with £210,611. Within the Commonwealth, India was the best customer with purchases of £191,028. Australia (£307,430) and South Africa (£237,464) were the best markets for telegraph and telephone material, followed closely by New Zealand which bought equipment valued at £236,846. India was the best customer for cables and wires with a value of £549,255, and was followed by the United States which made purchases valued at £291,609.



The electrical exports are analysed in Table I, while Table II shows their destinations. Other electrical exports not shown in Table I include the following:—

Electrically operated washing machines, complete, not exceeding 150 lb net weight: June, £219,252; six months, £1,777,948. Ditto, 150-250 lb net weight: June, £78,658; six months, £617,195. Parts: June, £57,619; six months, £359,273.

Electric carbons, including parts: June, £63,150; six months, £339,647.

Welding electrodes (excluding carbon), covered: June, £129,707; six months, £748,339.

Electric conduit tubes and cased tubes: June, £88,094; six months, £508,913.

Electric locomotives: June, £321,740; six months, £2,321,195. I.c. engines with electrical transmission: June, £173,552; six months, £644,951.

Electrical Imports

Imports of electrical machinery, apparatus and appliances for the first six months of this year totalled £12,743,398, as compared with £11,990,599 for January-June, 1956. The total value in June this year was £1,894,693, as compared with £2,131,748 in June, 1956. The United States (£493,532), Western Germany (£363,005) and the Netherlands (£295,972) continued to be the leading suppliers.

Proposed Channel Tunnel Study Group

The protocol of an agreement to set up a study group for the Channel Tunnel project was signed in Paris last week. *The Times*' correspondent says the protocol stipulates that the studies to be undertaken will concern the construction of road and rail tunnels capable of carrying electric power and oil.

NEW ELECTRICAL EQUIPMENT

Power Battery

A battery known as the "Pg" type is now being produced by OLDHAM & SON, LTD., Denton, Manchester. Its range of applications include mine lighting, wire traction, passenger vehicles, battery vehicles and mechanical handling. This new battery has a double-sleeve, multi-tube positive plate which combines the benefits of vitreous felt retainer mats and of plastic outer insulation. The company claims that the "Pg" type of tubular positive plate answers deterioration problems, for all the components are virtually unaffected by continuous and long immersion in acid, whilst the mechanical construction is such that shedding of the active material, either through normal cycling or exterior vibration, is eliminated.

The "Pg" plate consists of a number of thin p.v.c. tubes each of which, by reason of its greater inherent strength, can be perforated to provide a greater accessibility of the electrolyte to the active material than is possible with conventional slitted tube construction. In addition each p.v.c. tube is lined with a woven glass fibre sleeve, the assembly being centred on a feathered "X" metal spine. The active material is closely packed into the space between the spine and the glass fibre sleeve. In use the glass fibre sleeve becomes securely embedded in the active material which is therefore positively retained, so contributing to longer life.

Industrial Lighting Reflector

It is announced by F. W. THORPE, LTD., Welby Road, Hall Green, Birmingham, 28, manufacturers of the "Thorlux" range of industrial lighting fittings, that they have now incorporated apertures in the top of their overlamp dispersive reflectors for tungsten lamps. This new patent design is the "Toplite" overlamp reflector and it allows a proportion of the illumination to reflect upwards towards the ceiling, thus overcoming the "dark tunnel" effect which is usual with the normal type of dispersive reflector. When the reflector is erected at the recommended height the apertures are invisible. It also incorporates easy twist and turn detaching and replacing action for easy maintenance.

W. Thorpe "Toplite" overlamp reflector

Snap-lock Switch

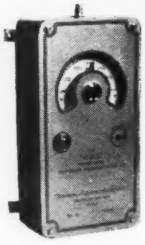
A neutral position snap-lock switch will shortly be available from BURTON, GRIFFITHS & CO., LTD., Mackadown Lane, Kitts Green, Birmingham. A movement of the operating lever 6 deg to either side will operate the snap action and close the circuit on that particular side. The lever is returned to the centre position by spring pressure, the circuit being broken after 5 deg of return movement. About 28 deg of safety or over-travel is provided on each side, but it is recommended that not more than 6 deg shall be used regularly. The switch has silver contacts with the usual snap-lock wiping action; it is housed in a waterproof case with a tightly fitted conduit entry and cover plate.

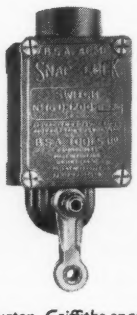
Temperature Indicator/Controller

A proportioning temperature indicator/controller recently introduced by TECHNICAL-EQUIPMENT-SERVICES, 43, Satanita Road, Westcliff-on-Sea, Essex, is non-electronic and of robust design, and a high degree of control accuracy is claimed for it. The proportioning band may be readily adjusted to suit the user's heat supply/demand conditions. Various ranges are available, from below 0 deg to over 250 deg C. Prices are from £30, according to range and fittings.

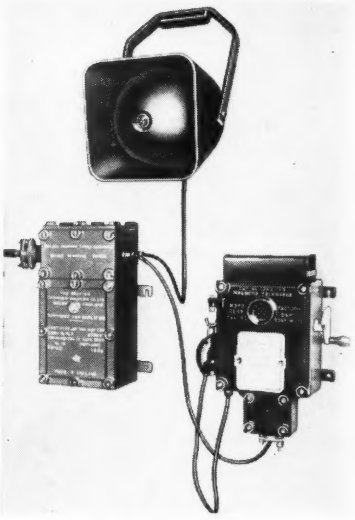
A liquid-filled bulb, capillary and bellows are employed and the thermo-

"H.W.B." proportioning temperature indicator/controller by Technical-Equipment-Services





Burton, Griffiths snap-lock switch



Typical B.T.H. "Portavox" equipment

electric proportioning system allows the temperature to "inch" up or down to the selected control point. Temperature overshoot and undershoot are eliminated. The instrument has proved successful in stabilising plastics processing temperatures.

Mine Telephone

It has been found necessary to introduce some form of speech reinforcement for the conventional underground telephone system at important points in mines. The "Portavox" amplifier and loudspeaker have been developed by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2, specially for this purpose and are now in production. The equipment is installed in addition to the mine telephone, and serves to amplify and reproduce through a loudspeaker the signals normally reproduced by the telephone earpiece. It is intrinsically safe and flameproof, and certificate number IS.1066 and FLP.3832/A has been granted by the Ministry.

Loudspeaking communication can be achieved over the normal telephone circuit by holding the earpiece hook down when receiving a message and releasing it when speaking into the mouthpiece. The equipment is mains-operated from 110 or 240 V 50 c/s supplies. The amplifier is resiliently mounted within the flameproof enclosure and suitably certified terminations are provided for connections.

In circumstances which make it imperative for immediate verbal warning to be given to operators, instructions can be readily broadcast at high volume by the new amplifier and loudspeaker. The connections to a party line merely require a pair of additional conductors for the "Portavox" in parallel with the system.

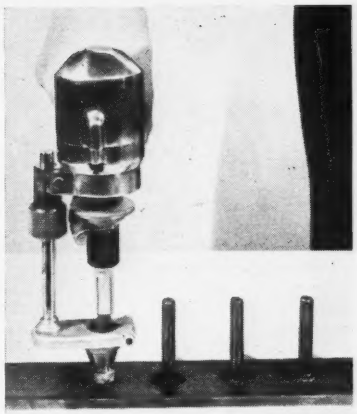
New Stud Welding Equipment

TO meet the need for a lighter, more compact stud welding unit, with means of self-adjustment to cater for small variations in stud or attachment length, the "Cromp-Arc" J/K equipment has been produced by the Stud Welding Organisation of Crompton Parkinson, Ltd.

The handtool weighs just over 5½ lb and measures only 7½in overall when loaded with a 1in long stud ready for welding. The self-adjustment requirement has been met so that consistent stud lift or arc length can be maintained despite variations in stud or attachment length by ±¼in. To cater for the different stud sizes, a range of taper shank chucks and ferrule grips are provided, together with tools for adjustment. The tool body is built up from two light alloy shell castings with an integral pistol type handle enclosing the operating coils and adjustable lifting device: weld and control cables enter at the heel of the handle, providing good balance for the tool's use.

A rotatable clamp ring is provided on the nose of the tool which affords a quick and simple means of gripping an adjustable leg, the length of which may be quickly varied to accommodate different lengths of attachment up to 3½in long. A single-point foot at the bottom of the adjustable leg is interchangeable with the standard feet of the established "Nelson" stud welding tools and it can therefore take the complete range of "Nelson" standard ferrule grips which are provided.

The controller weighs only 26 lb and is 7½in wide, 11½in deep and 11½in high. The equipment comprises a drip-proof, sheet steel, vented case with a carrying handle and rubber feet, and is finished in durable silver grey hammer stove enamel. The front panel is recessed to provide protection for the timer control, plugs and sockets and pilot lamp mounted on it. Welding plugs are mounted behind and shielded by the front panel on which a watertight 4-pin socket is provided for handtool control circuits. For connections between the controller and source of welding current, the controller and handtool, and the source of welding current and work, a set of cables 15ft in length is provided as standard.



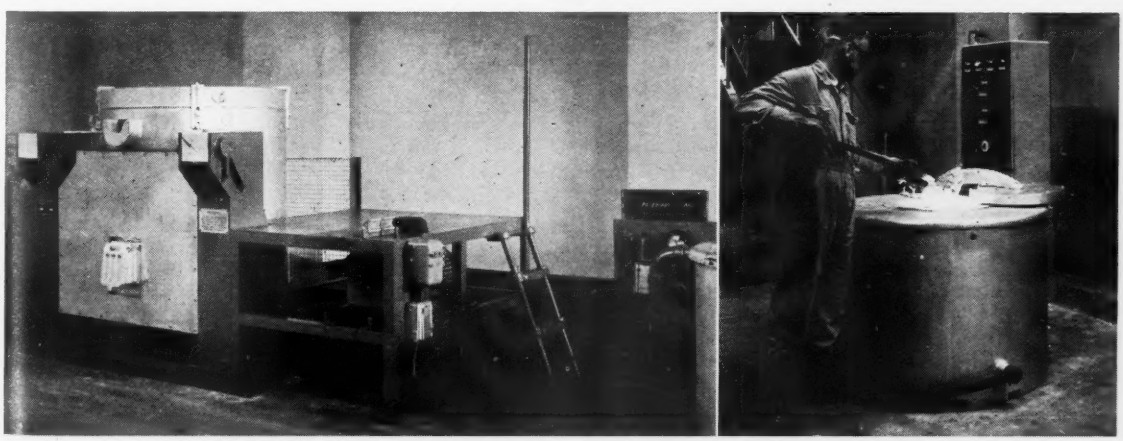
"Cromp-Arc" J/K stud welding equipment

Electric Diecasting Furnace

DEVELOPED as a result of collaboration between the Morgan Crucible Co., Ltd., and Birlec, Ltd., the type "EDF" Mk. 1 furnace is a 300 lb/135 kg, 25 kW electric heating furnace for maintaining aluminium and aluminium alloys at a temperature of up to 800 deg C. It is suitable for connection to three-phase, 50 c/s, 4-wire supply with voltages ranging between 380 and 440. Automatic control of the heating ensures constant performance from the furnace and variations in metal quality are avoided. By fitting an automatic time switch, the furnace can be ready for instant use and can assist in reducing the costs involved in starting up the plant before normal working time. A foot-operated insulated cover reduces operator fatigue and effectively prevents heat radiation. The fully-automatic temperature control gear is housed in a self-contained floor mounting control cabinet.

The lining is of an outer layer of insulating slabs, with two inner layers of refractory insulating bricks. The hot face is of moulded refractory bricks forming element carriers, manufactured by Coupe & Tidman, Ltd., an associated company. The heating elements are nickel-chrome alloy wire, in coil formation, with lead-out rods through the furnace brickwork to external terminals which are provided with a ventilated guard. Element life is estimated at 1½ to 2 years. The control is "on-off" by means of a constantly immersed thermocouple which is protected by a mullite-silicon carbide composite sheath. The temperature indicator controller is a millivoltmeter type and a "Pyrolimit" indicator is fitted to prevent the elements rising above a safe temperature, the thermocouple being in the lower part of the furnace chamber. Both instruments have a broken thermocouple safety device. Manual operation is provided against instrument or couple failure, overriding the auto-control gear but not the element safety device.

A maximum working throughput of 80 lb/36 kg per hour can be achieved at the full rating of 25 kW.



Birlec-Morgan electric diecaster, type "EDF" Mk. 1, showing (right) pedal operation of cover

Financial Section

STOCKS and SHARES

INTEREST in Stock Exchange markets has been occupied mainly of late with the signs of a sorely-needed recovery in the value of Government securities, most of which touched their lowest recorded depths about the middle of last month. Towards the end of it, prices had drawn clear of those levels, and although the movement wavered too much to inspire a great deal of confidence, it had done something to resurrect hopes that the gilt-edged market was past the worst. Concurrently industrials remained subdued by the further evidence, in the annual report of the General Electric and other companies, of the manner in which earnings are being squeezed by the rise in wages and other production costs.

Price Changes

Changes in electrical share prices have been irregular, with the tendency slightly downward. G.E.C. remained at 50s after the appearance of the full report, which explained the decision to reduce the rate of the final dividend by reference to the continued pressure of wage increases on profit margins and to the considerable expenditure involved in the group's development plans. Hackbridge Holdings were marked down to 15s 9d (the official quotation being 15s) after the announcement of lower earnings and the reduction of the dividend from a total of 30 to 20 per cent. Plessey, which were 86s at the beginning of last month, receded further to 77s 6d. Brook Motors 10s shares at 37s 6d remain around their best price of the year, and are showing a yield of $6\frac{2}{3}$ per cent on the 25 per cent rate of dividend. In the group of "nuclear power" shares, Simon-Carves came back 2s to 34s 3d, but Babcock & Wilcox recovered about the same amount to 74s 3d. Enfield Cable reacted to 16s 6d after the previous week's jump of 4s to 18s.

E. K. Cole

At the annual meeting of the E. K. Cole Company, the chairman told shareholders of a sudden and very steep increase last September in the demand for the company's television and radio products (which continue to provide the greater part of the group's earnings) and of continued activity at a high level well into the present year. In the first half of the year ended last March, business suffered severely through the Government's financial restrictions. In the result, total turnover of the group was maintained at about the previous volume. Net profits at £758,000 (before tax) were within £15,000 of the previous figure, and the surplus provided threefold cover for the ordinary dividend of $17\frac{1}{2}$ per cent, the same rate as before. Having been quoted at times last year down to 15s, the 5s shares have improved to 21s.

Ultra Electric Prospects

Shareholders of Ultra Electric (Holdings) were also given a good account of

Price Changes in

Company or Board	Nom. Value	Middle price 29th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
						£ s d		
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	72½		3	3	4 2 9	80	71⅛
Brit. Elec. 1974/77	100	70½		3	3	4 5 0	78¼	69½
Brit. Elec. 1976/79	100	73½		3½	3½	4 15 3	81½	73½
Brit. Elec. 1974/79	100	85½	+1	4¼	4¼	4 19 6	92½	83½
Overseas Electric Supply								
Calcutta Elec.	£1	16/3	+1/3	6†	6†	7 7 9†	19/-	15/-
East African Power	£1	20/-		7	7	7 0 0	21/-	19/-
Nigerian Elec.	£1	17/6		10	10*	11 8 6	18/6	17/3
Perak Hydro-Elec.	£1	17/6		10	10*	11 8 6	18/-	13/3
Electrical Shares								
Aberdare Cables	5/-	12/6		17½	17½	7 0 0	12/6	9/9
Aerialite	1/-	6/6		45	48	7 7 6	6/6	4/9
Allen, W. H.	£1	47/-		10	10	4 5 0	47/3	33/6
Anglo-Portuguese Tel.	£1	24/9		8	8	6 9 3	27/6	20/6
Aron Elec. Ord.	£1	58/9		15	15	5 2 3	60/-	53/6
Assd. Automation	10/-	23/9		5	7½	3 3 3	24/9	17/9
Assoc. Elec. Ord.	£1	61/3		15	15	4 18 0	73/-	61/3
Automatic Tel. & El.	£1	75/-		15	17	4 10 9	75/-	54/6
Babcock & Wilcox	£1	74/3	+2/3	15	15	4 0 9	82/6	70/-
Bakelite	10/-	23/9		16	15	6 6 3	24/6	20/9
Baldwin, H. J.	2/-	4/-		20	20	10 0 0	5/-	3/10½
Berry's Electric	5/-	6/-		—	10	8 6 9	6/3	5/6
British Aluminium	£1	63/9		12	12	3 15 3	71/3	63/9
Brit. Elec. Traction: Def. Ord. "A"	5/-	24/6	+6d	22½	25	5 2 0	24/6	17/-
B.I. Callender's	£1	51/3	+3d	12½	12½	4 17 6	55/-	48/3
B.I. Callender's 6% Pref	£1	20/-	+6d	6	6	6 0 0	21/9	19/6
British Tabulating	£1	55/-		9	9	3 5 6	56/3	42/-
British Thermostat	5/-	25/-		25	25	5 0 0	27/6	25/-
British Vac. Cleaner	5/-	6/-		15	10	8 6 9	8/-	6/-
Brook Motors	10/-	37/6		25	25	6 13 3	37/6	30/-
Brush Group	5/-	7/9		10	Nil	—	8/-	4/6
Bulgin, A. F.	1/-	4/6		50	40*	8 17 9	5/6	4/6
Burco Dean	5/-	13/9		22½	20	7 5 6	14/-	8/9
Cable & Wireless: Ord.	5/-	12/3		10	10	4 1 9	12/6	9/6
4% Loan	100	90½		4	4	4 8 6	92½	89
Chloride El. Storage "A"	£1	66/3		17½	17½	5 5 9	68/9	58/-
Clarke Chapman	£1	172/6		22½	27½	3 3 9	9	6½
Cole, E. K.	5/-	21/-	+3d	17½	17½	4 3 3	23/6	16/6
Cossor, A. C.	5/-	6/3	+6d	15	Nil	Nil	7/3	5/9
Crabtree	10/-	25/6		20	20	7 17 0	26/-	23/3
Crompton Parkinson Ord.	5/-	17/6		16	16	4 11 3	17/9	14/6
De La Rue	5/-	23/-	+3d	30	35	7 12 3	24/6	16/3
Decca "A"	4/-	29/6		43¾	43¾	5 18 9	32/3	26/10½
Desoutter	5/-	35/6		30	32½	4 11 6	35/6	27/6
Dewhurst	2/-	7/6		30	16¼*	4 6 9	7/6	5/9
Dictograph Tel.	2/-	5/9		20	20	—	6/3	5/9
Dubilier Condenser	1/-	7/-		30	30	4 5 9	7/6	5/6
Duport	5/-	19/-		23	25	6 11 6	19/6	17/6
E.M.I.	10/-	34/6		15	15	4 7 0	34/9	23/9
Electrical Components	5/-	8/-	+6d	25	12½*	7 16 3	8/-	6/6
Elec. Construction	£1	26/3		8½	8½	6 9 6	27/6	21/9
Elliott Bros.	5/-	30/6	−1/-	17½	20	3 5 6	33/6	26/3
Enfield Cable Ord.	£1	16/6	−1/6	Nil	Nil	Nil	21/6	13/-
English Electric	£1	62/6		12½	14	4 9 6	65/-	47/6
English Electric 3¾% Pref.	£1	12/-		3¾	3¾	6 5 0	14/3	13/-
Ericsson Tel.	5/-	50/-		20†	22†	2 4 0†	50/-	33/3
Ever Ready	5/-	18/6	−3d	35	37½	5 1 3*	20/-	15/-
Falk Stadelmann	£1	37/6	−2/-	17½	17½	9 6 9	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

current business at their annual meeting. Sales since the end of the last financial year, in March, have been higher than in the corresponding period of any previous year. A good season is anticipated for the radio and television sections, while the Special Products Division (which is of about equal importance in terms of turnover) is well employed, and is not expected to suffer from changes in the defence programme. For last year the dividend was reduced from 15 to 7½ per cent, and a yield of not much over 4 per cent on the 5s shares at 9s suggests confidence in the prospect of at least a partial restoration of the higher rate in due course.

Aiton & Co.

The 10s shares of Aiton & Co. are quoted at about 76s 3d, offering a yield of approximately 3¼ per cent on the basis of the 25 per cent dividend paid for 1956–7. This payment came in the highly conservative class, being covered by earnings equivalent to a rate some six times greater on the nominal ordinary capital of £250,000. Through the continuous ploughing back of profits (only £5,000 new money has been added to the original capital of £5,000 when the company was formed over 50 years ago) the reserves have reached proportions to provide amply for the trebling of the ordinary capital through a proposed two-for-one scrip issue. The chairman said recently that among the contracts on hand there was work to the value of nearly £2 million in supplying plant to the new High Marnham power station.

Commercial T.V.

Although no direct interest is available to investors in the future of commercial television, there are indirect means for participation through the shares of such companies as British Electric Traction and Broadcast Relay Service, which hold a large part of the capital of Associated-Rediffusion. It is apparent now that the new industry has progressed beyond the phase of heavy initial losses into the profitable stage. There is evidence of this in Mr. H. C. Drayton's report to B.E.T. stockholders that Associated-Rediffusion has lately repaid a substantial part of the temporary advances lent by B.E.T., and that he is extremely satisfied with progress. Mr. Spencer Wills spoke in similar terms at the Broadcast Relay meeting. The latter company's 5s shares are quoted at 25s, and B.E.T. 5s "A" shares at 24s 6d, the yields on the latest dividends being 4·4 and 5·1 per cent respectively.

Shares on Offer

Electrical shares recently on offer in reasonable numbers include James Scott 5s ordinary at 15s 6d, showing a yield of about 6½ per cent on the recently increased dividend of 20 per cent. A similar return is offered by Contactor Switchgear 5s shares at 13s 9d, while on Venner 5s shares at 10s 6d, the yield is in the neighbourhood of 7 per cent. On Electrical Apparatus 5s new shares (the result of the scrip issue) the indicated yield at 11s, free of stamp duty, is a little over 5 per cent, and on Efco 10s shares at 23s 3d it is nearer 5½ per cent.

It is regretted that Brook Motors' dividend has been incorrectly given in two or three past issues; this has now been put right.

Electrical Investments

Company or Board	Nom. Value	Middle price 29th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1957 Highest	1957 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	50/-		14	12½	5 0 0	58/9	48/9
G.E.C. 6½ Pref.	£1	20/6		6½	6½	6 6 9	23/6	20/6
General Cables	5/-	15/6		30	30	9 13 6	15/6	11/6
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	47/6	45/3
Hackbridge Holdings	5/-	15/-	−4/3	30	20	6 13 3	21/9	15/-
Hackbridge & Hewittic	5/-	13/9	−1/3	23	20	7 5 6	16/-	13/6
Head Wrightson	£1	140/-	−3/9	20	22½	3 4 3	146/3	112/6
Heatrae	2/-	4/9		15	15	6 6 6	4/9	4/-
Henley's	10/-	15/-		11½	11½	7 13 3	17/-	15/-
Holophane	5/-	23/9	−1/3	30	30	6 6 3	26/3	17/-
Hoover	5/-	40/-		50	50	6 5 0	44/-	24/9
I.C.I.	£1	45/-		10	10	4 9 0	46/6	37/9
Intl. Combustion	5/-	26/6	−9d	20	22½	4 5 0	30/-	20/-
Johnson & Phillips	£1	27/-	−6d	15	10	7 8 3	34/6	27/-
Lancashire Dynamo	£1	41/3	−1/3	11	11	5 6 9	45/-	36/9
Laurence, Scott	5/-	17/3		15	15	4 7 0	19/9	13/9
Lister, R. A.	£1	32/-		10	10	6 5 0	33/9	26/9
London Elec. Wire	£1	48/-		12½	12½	5 4 3	53/9	43/-
Lucas, J.	£1	33/-	−9d	7½	7½	4 11 0	36/6	30/6
Marconi Marine	£1	37/-		10	10	5 8 0	37/-	31/-
Marryat & Scott	2/-	12/6		30	35	5 12 0	13/-	8/-
Mather & Platt	£1	58/9		15	15	5 2 3	63/9	51/3
Metal Industries	£1	27/6	−6d	Nil	9	6 11 0	30/-	20/3
Midland Elec. Mfg.	£1	48/9		12½	12½	5 2 6	48/9	45/-
Morphy-Richards	4/-	19/6	−6d	50	50	4 2 0*	20/-	11/9
Murex	£1	72/6	+9d	20	20	5 10 3	79/6	65/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/1
Oldham & Son	1/-	2/9		17½	17½	6 7 3	2/9	2/3
Parnall (Yate)	5/-	7/3		12	12	8 5 6	8/9	5/9
Parsons, C. A.	£1	66/3		10	8½*	—	71/3	50/6
Plessey	10/-	77/6	−2/6	27½	30	3 17 6	86/3	61/-
Pye "A" Deferred	5/-	18/9		12½	12½	3 6 6	20/-	15/9
Reyrolle	£1	100/-	−1/3	16¼	17½	3 10 0	110/-	90/-
Rheostatic	4/-	9/-		18½	12½*	5 11 0	10/-	8/9
Richardsons Westgarth	5/-	18/9	+3d	16⅝	16⅝	4 9 0	20/-	17/-
Scottish Cables	4/-	18/3		27½	27½	6 0 6	19/3	15/-
Simon-Carves	5/-	34/3	−2/-	28¾	20*	2 18 6	36/3	26/-
Smith (England), S.	4/-	15/-		17½	17½	4 13 3	15/9	13/-
Southern Areas	£1	15/6		7½	7½	9 13 6	20/-	13/9
Strand Elec.	5/-	7/3		15	15	10 6 9	8/-	7/3
Sturtevant	5/-	23/-		15†	15†	3 5 3†	27/-	22/9
Sun Elec.	£1	43/9		20	25	11 8 6	43/9	43/9
Switchgear & Cowans	5/-	13/9		25	25	9 1 9	15/6	13/6
Taylor Tunnicliff	5/-	12/9		15	15	5 17 9	13/9	11/9
T.C.C.	10/-	40/-		25	25	6 5 0	40/-	35/-
T.C. & M.	£1	25/-		8½	8½	6 16 0	31/-	24/6
Telephone Mfg.	5/-	5/9	−3d	10	10	8 14 0	8/-	5/9
Telephone Rentals	5/-	12/-		12½	12½	5 4 3	12/6	10/3
Thompson (John)	5/-	33/-		25	25	3 15 9	37/-	29/3
Thorn Elec.	5/-	24/6	−6d	15	15	3 1 3	26/3	16/3
Thornycroft	£1	28/9		15	12½	8 14 0	37/6	28/9
Tube Investments	£1	67/-	+6d	22½	15*‡	4 9 6	68/9	58/3
Vactric	5/-	20/-	−9d	17½	25	6 5 0	23/9	12/9
Veritys	5/-	8/-	−6d	12½	12½	7 16 3	9/3	8/-
Walsall Conduits	4/-	13/6	−3d	20	20	5 18 6	15/-	11/-
Ward & Goldstone	5/-	55/9		35	40	3 11 9	56/3	36/9
Watford	2/-	6/6		25	25	7 13 9	6/9	6/3
Westinghouse	£1	37/6		18	9‡	4 16 0	41/3	36/-
West, Allen	5/-	12/6		15	15	—	13/6	9/6
Wolf Electric	5/-	11/-		20	20	4 10 9*	13/6	8/9

REPORTS and DIVIDENDS

E. K. Cole, Ltd.—In the course of his speech at the annual meeting held on 23rd July, Mr. E. K. Cole (chairman and managing director) said that turnover during the year under review was substantially maintained as compared with the previous year. Domestic radio and television continued to contribute the larger proportion of the turnover and profits, but as a result of Government restrictions the radio and television industry, in common with others, suffered a considerable setback, the worst effect being that large finished stocks were left in the hands of many manufacturers and dealers in the early part of the year and that position continued to a degree until the beginning of September last. In that month the demand for their products increased suddenly and very steeply, was maintained well into 1957 and continued at a high level to date with a seasonal drop less than usual. Sound radio did not step up so heavily as television and public interest in the new v.h.f. sound transmissions of the B.B.C. was not as great as had been hoped. Total car radio sales suffered severely due to the substantial fall in the motor car market. In the case of both v.h.f. radio and car radio the position now seemed to be steadily improving. The company had recently launched a new range of television receivers at popular prices including important additions of combined television and v.h.f. sound models in the lower price brackets. Their subsidiary, Egen Electric, Ltd., which made radio components, had a satisfactory year and the demand for its products continued to increase. Following arrangements with Ferranti, Ltd., to take over the marketing of domestic radio and television receivers under the Ferranti trade mark, a new company was formed in January last.

The subsidiary, Ekco Electronics, Ltd., had made further progress and the turnover was increased. Approximately 50 per cent of the total was exported. They had supplied the first complete nucleonic instrumentation and control circuitry for the Australian experimental atomic reactor and also had contracts in hand for the supply of similar equipment for the Dounreay and Harwell reactors now under construction. Further progress had been made in the applications of nuclear measuring equipment in the fields of medicine, scientific research and the ever-growing needs of industry. Trading conditions in the plastics industry over the year were not easy, but the turnover and profits of this division were well maintained.

The export turnover of the group substantially increased during the year, although the trading conditions in the domestic radio field still remained difficult and margins small.

Although the turnover of the heating division showed a small increase over that of last year, the sale of electric heating devices suffered as the result of the mild winter. The recently marketed electric storage heater had met with approval. Apart from their domestic sales they had been concerned with many important industrial and commercial heating projects for the London Airport, Surrey County Council and the I.T.A. television stations.

The General Electric Co., Ltd.—The report and accounts for the year ended 31st March last, now issued, show that the consolidated profit on trading amounted to £9,613,501, as compared with £9,752,774 for the preceding year, to which is added income from investments of £291,585, making £9,905,086. After deducting £2,045,199 for depreciation and making other provisions, there is a balance of £6,168,170. United Kingdom and overseas taxation requires £3,245,076 and the profit attributable to minority shareholders in subsidiary companies is £165,760. The consolidated net profit attributable to the holding company is £2,397,336 (against £2,759,417). As we reported in our last issue, the proposed final ordinary dividend is 8 per cent, making 12½ per cent for the year on capital of £18 million. This compares with a total of 14 per cent for the preceding year on capital of £13,714,680. The balance carried forward is £4,962,341 (against £4,879,351 brought in).

The directors state in their report that the sales for the year showed a steady increase and exceeded those of the previous year by 10 per cent. In spite of this, the rise in costs could not be fully recovered, with the result that the profit margins were reduced. The rise in costs is mainly due to the widespread effects of the wage increases awarded to labour. Total exports reached a record figure of nearly £24 million. At the same time the overseas companies have had to contend with difficult trading conditions but have made overall a better contribution to the profits.

Orders received during the year, excluding the large atomic energy contract, have exceeded those of the previous year by 7·5 per cent and constitute a new record.

During the year the M-O Valve Co., Ltd., became a subsidiary company of the G.E.C. and has contributed to the increase in the capital reserves arising during the year.

As far as the current year is concerned, whilst the increase in orders has continued, the further outlook depends on greater stability in the country's economic position. It is difficult at present to foresee an immediate relief from the pressure on profit margins in view of the overall effects of the further wage advances which have taken place. The group also has to face further considerable development expenditure in connection with the new fields in which it is engaged, such as atomic energy and electronics. It is for these reasons that the directors think it prudent to recommend a reduction in the rate of dividend for the year. The annual meeting will be held on 5th September.

Pirelli-General Cable Works, Ltd., reports a net profit for the year to 31st March last of £332,130, as compared with £672,899 for the previous year. This figure is arrived at after deducting £323,787 for taxation. The dividend for the year is 15 per cent (against 10 per cent), and the balance carried forward is £1,772,191 (against £1,591,606 brought in).

Thomas De La Rue & Co., Ltd.—In dealing with the plastics side of the business at the annual meeting on 24th July, Mr. B. C. Westall (chairman) referred to the agreement with the American Cyanamid Co. and said that an important item in the agreement was the provision, for a period of twenty-five years, for full exchange of technical information in the field of laminated plastics. They attached considerable importance to the fact that their export markets, particularly in the Far Eastern area, had been greatly expanded, and both for American Cyanamid and themselves the fact that they were marketing plastic products throughout the world under the common trade mark of "Formica" on a permanent basis would give immense advantages over their competitors.

Murex, Ltd., report a decline in group profits for the year to 30th April last, the figure of £798,000 comparing with £1,245,000 for 1955-56. After deducting £446,000 for taxation, the net profit is £352,000 (against £579,000). The company states that the fall in profits is mainly due to the decline in the price of tungsten which resulted in heavy losses on the turnover of stocks. Despite the fall in profit the ordinary dividend for the year is maintained at 20 per cent with a final dividend of 12½ per cent. The balance carried forward is £123,000 (against £185,000 brought in). The directors state that sales of products, other than tungsten, were maintained at a satisfactory level although the difficulty of obtaining adequate supplies of certain raw materials, notably molybdenum and vanadium ores, from overseas has persisted.

British Relay Wireless & Television, Ltd., reports a consolidated trading profit of £966,147 for the year to 30th April last, as compared with £738,216 for the preceding year, and after meeting all charges, including £200,995 for taxation, the net balance is £199,253 (against £250,380). It is proposed to pay a final dividend of 15 per cent on the "A" ordinary capital, making 20

per cent for the year (against 16 per cent), and a first dividend of 20 per cent on the "B" ordinary shares for the year. The "B" shares were not entitled to any distribution until not less than 16 per cent had been paid on the "A" shares for three consecutive financial periods. Under the articles, following the dividend declaration at the meeting to be held on 6th September, the "B" ordinary shares will be consolidated into one class with the "A" ordinary shares and rank *pari passu* in all respects.

Automation Merger.—The boards of Elliott Brothers (London), Ltd., and Associated Automation, Ltd., announce that they consider a merger between Elliotts and Associated Automation would be in the best interests of the shareholders of both companies. The two companies are prominently engaged in automation and their activities are, in the main, complementary. A scheme has been formulated by the financial advisers to put such a merger into operation and the boards of the two companies propose to recommend the scheme to their shareholders. Its main features are:—The merger to be effected through a holding company, the chairman of which would be Mr. R. E. F. de Trafford, chairman of Elliotts. The holding company would issue its ordinary shares in exchange for the ordinary shares of the two companies, in the proportion of eight shares of 5s for every four shares of 5s of Elliotts, and eight shares of 5s for every five shares of 10s of Associated Automation. It is envisaged that the holding company would offer its preference shares in exchange for the preference shares of Elliotts.

Pinchin Johnson & Associates, Ltd., report combined profits for the year to 31st March last of £1,641,294, as compared with £1,956,738 for 1955-56, and after meeting all charges, including £896,842 for taxation, the net balance attributable to the parent company is £580,676 (against £678,572). The dividend for the year on the ordinary capital is maintained at 16⅔ per cent by a final payment of 11⅓ per cent.

Permali, Ltd.—The profit of the British companies of the group for the year ended 31st March last is £138,932, as compared with £136,705 for 1955-56. Taxation requires £78,899 and the net profit is £60,033 (against £73,696). It is proposed to pay a final dividend of 8 per cent, making 13⅓ per cent for the year.

Britannia Electric Lamp Works, Ltd., reports a group profit for the year to 31st March last of £58,604, as compared with £69,350 for 1955-56. The dividend for the year is unchanged at 12½ per cent.

Hackbridge Holdings, Ltd. (formerly Hackbridge Cable Holdings, Ltd.).—After deducting £189,819 for taxation, the group net profit for the year ended 31st March last is £122,168, as compared with £187,105 for 1955-56. It is proposed to pay a final dividend of 10 per cent (against 20 per cent), making 20 per cent for the year (30 per cent).

The British Oxygen Co., Ltd., has declared an interim dividend of 4 per cent (unchanged).

Blaw Knox, Ltd., are paying an unchanged interim dividend of 10 per cent.

Increases of Capital

Nalder Bros. & Thompson, Ltd.—Increased by £50,000, in £1 ordinary shares, beyond the registered capital of £115,000.

Wolf Electric Tools (Holdings), Ltd.—Increased by £660,000, in 5s shares, beyond the registered capital of £400,000.

Sydney S. Bird & Sons, Ltd.—Increased by £100,000 in 500,000 shares of 4s, beyond the registered capital of £300,000.

T. Beadle & Co., Ltd.—Increased by £320,000 to £500,000 in 20s ordinary shares.

New Companies

Brewer Bros. & Co. (Electrical), Ltd.—Registered 16th May. Capital £3,000. To acquire the business of an electrical engineer and contractor carried on by F. B. Waters at Cardiff as Brewer Bros. & Co., etc. Directors: F. B. Waters and Evelyn Waters. Regd. office: 3, Womanby Street, Cardiff.

Transistor Development Co., Ltd.—Registered 15th May. Capital £100. Manufacturers of and dealers in electronic, electrical and mechanical equipment and machinery, etc. Directors: H. F. Scriven, A. E. Wickson and T. Wilde. Regd. office: 37, High Town Road, Luton, Beds.

Northern Electrical Factors (Leigh), Ltd.—Registered 17th May. Capital £2,000. Manufacturers and repairers of, agents for and dealers in artificial lighting apparatus, electrical plant, radio apparatus, etc. Directors: T. Farrimond and J. Monks. Regd. office: 6-10, Brown Street, Leigh, Lancs.

D. & L. Electrical Services, Ltd.—Registered 6th June. Capital £1,000. Electricians, electrical contractors and engineers, manufacturers of and dealers in dynamos, motors, armatures, magnetos, electronic equipment, etc. Directors: F. R. Lightfoot and D. V. Donaldson. Regd. office: 254, Liverpool Road, Newcastle under Lyme.

W. H. Smith & Partners (West Africa), Ltd.—Registered 6th June. Capital £1,000. Manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, batteries, etc. Directors: W. H. Smith and Kathleen M. Smith. Regd. office: 39, St. James's Street, S.W.1.

F. D. Pratt, Ltd.—Registered 6th May. Capital £1,000. Electrical engineers, etc. Directors: W. H. Milligan and F. D. Pratt. Regd. office: 106, High Street, Datchet, Bucks.

Cowan's (Electrical Contractors), Ltd.—Registered 9th May. Capital £3,000. Directors: B. G. Cowan and Mrs. Marie P. E. Cowan. Regd. office: 12, Buckingham Street, W.C.2.

Anglia Electrical, Ltd.—Registered 11th June. Capital £1,000. Manufacturers of and dealers in electrical, electronic, and mechanical devices, transformers, motors, dynamos, alternators, switchgear, etc. Directors: F. R. Shenton, D. B. Eagle and G. H. P. Clowes. Solicitors: Gerard Dunne & Co., Baltic Chambers, Waveney Road, Lowestoft.

Blackburn & Murgatroyd, Ltd.—Registered 12th April. Capital £1,000. Electricians, etc. Directors: R. Blackburn and D. Frame. Regd. office: 10, Edge Lane, Stretford, Manchester.

Westborough Electrical, Ltd.—Registered 9th April. Capital £100. Electrical, radio, television and refrigeration engineers, etc. Directors: E. H. Norvall and Blanche E. V. Norvall. Regd. office: 153-5, Hamlet Court Road, Westcliff-on-Sea.

Gerard and Dorothy Whitcombe, Ltd.—Registered 17th April. Capital £5,000. Dealers in and repairers and makers of electrical goods of all kinds, etc. Directors: G. G. Whitcombe and Mrs. Dorothy Whitcombe. Regd. office: 112, The Broadway, Southall.

Stephenson Bros. Electrical, Ltd.—Registered 23rd April. Capital £500. Manufacturers of and dealers in electrical goods of all kinds, etc. Solicitors: Austin & Co., 1, Park Square, Leeds, 1.

Fenny Electrical Co., Ltd.—Registered 24th May. Capital £1,000. Manufacturers, importers, exporters, agents for and dealers in electrical, electronic and mechanical devices, transformers, motor dynamos, alternators, switchgear, resistances, etc. Solicitors: E. T. Ray & Co., 46, Bletchley Road, Bletchley, Bucks.

Dawson & Gibbons, Ltd.—Registered 24th June. Capital £1,000. Electrical engineers and contractors, etc. Directors: J. W. Dawson and A. E. Gibbons. Secretary: A. E. Gibbons, Regd. office: 55, Red Lion Street, W.C.1.

Merithew, Ltd.—Registered 25th June. Capital £2,000. Manufacturers and repairers of and dealers in artificial lighting apparatus, electrical plant, machinery, etc. R. H. Wertheim is the first director. Regd. office: 202, Hagley Road, Birmingham.

Bennison & Co. (Blackpool), Ltd.—Registered 28th June. Capital £2,000. To acquire the business of Bennisons of Bond Street, carried on by Mrs. M. Bennison at Blackpool; and to carry on the business of radio and television engineers, sound acoustic and electrical engineers, etc. Directors: L. I. Bennison and Mrs. Margaret Bennison. Regd. office: 66a, Bond Street, Blackpool.

Hadwins (Kendal), Ltd.—Registered 1st July. Capital £15,000. To acquire the business of radio, television and electrical engineers carried on at Finkle Street and Collin Croft, Kendal, as R. Hadwin & Son, etc. Directors: R. G. Hadwin and Mrs. Gladys Hadwin. Regd. office: 29-31, Finkle Street, Kendal.

M. & P. Fluorescent Fittings, Ltd.—Registered 31st May. Capital £100. Solicitors: Nutt & Oliver, Salisbury Square House, Salisbury Square, E.C.4.

Bankruptcies

A. C. Allport, lately carrying on business at 2, Creek Road, March, Cambs, under the style of Radio Repairs as an electrical dealer.—Receiving order made 10th July on a creditor's petition.

W. A. Carter, 32, Abbeville Road, Clapham, London, S.W.4, electrical engineer, lately carrying on business at 95, Hambalt Road, Clapham, London, S.W.4.—Public examination 13th September at the Court House, Garratt Lane, Wandsworth, S.W.18.

F. C. Burford, lately carrying on business under the style of Robin & Ford at 19, Ridgway, Edgbaston, Birmingham, electrical contractor.—Public examination 25th September at the Court House, Corporation Street, Birmingham, 4.

J. E. Stephens, lately carrying on business under the name of J. Edryd Stephens & Sons, at 10, Barn Road, Carmarthen, electrical engineer.—Trustee, Mr. H. Lord, Broyan House, Priory Street, Cardigan, appointed 10th July.

W. V. Tupling, 18, Nightingale Drive, Mansfield, Notts, electrician, carrying on business at 27, Church Street, Warsop.—First and final dividend of 4s 2d in the £, payable on and after 19th August at 126, Colmore Row, Birmingham, 3.

Liquidations

Glyndon Radio Service, Ltd.—Winding up voluntarily. Liquidator, Mr. H. C. Hedges, 4, Charterhouse Square, London, E.C.1, appointed 13th July. Particulars of claims to the liquidator by 30th Augsut.

Soundwell (Radio & Television) Co., Ltd.—Winding up voluntarily. Liquidator, Mr. L. H. Shipton, 31, Lloyd Street, Manchester, 2.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 7th August from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

7076. Machlett Laboratories, Inc.—Electronic tube and apparatus therefor. 27th March, 1951. (780838.)

23857. Elliott Bros. (London), Ltd.—Electric delay devices employing semi-conductors. 13th October, 1952. (780839.)

1952

17053. Telephone Manufacturing Co., Ltd.—Electrical apparatus including interference suppressors. 7th October, 1953. (780841.)

23346. General Electric Co., Ltd., and Harrold, A. E.—Electric capacitors. 17th December, 1953. (780843.)

29425. Low & Sons, Ltd., A.—Detachable insulated connectors for electrical conductors. 20th November, 1953. (780702.)

1953

51. General Electric Co.—Velocity modulation apparatus for the generation and translation of electromagnetic waves. 1st January, 1953. (780473.)

4601. Crompton Parkinson, Ltd.—Electric discharge lamps. 16th February, 1954. (780474.)

7309. Superheater Co., Ltd., and South, A. J.—Superheater arrangements for water tube boilers. 17th March, 1954. (780845.)

13440. General Electric Co., Ltd., Hawkins, F. S., and Losty, H. H. W.—Enclosed carbon arc lamps. 30th April, 1954. (780732.)

18323. Standard Telephones & Cables, Ltd.—Electron discharge apparatus. 25th June, 1954. (780478.)

21489. Canadian General Electric Co., Ltd.—Rotary ironers. 4th August, 1953. (780846.)

22435. Licentia Patent-Verwaltungs-Ges.—Transistor. 14th August, 1953. (780723.)

22739. Standard Telephones & Cables, Ltd.—Electrical switches employing bi-directional transistors. 13th August, 1954. (780831.)

23152. Accumulatoren-Fabrik Akt.-Ges.—Manufacture of negative electrodes for alkaline accumulators. 21st August, 1953. (780481.)

32264. General Electric Co., Ltd., and Goldsmid, H. J.—Thermoelectric devices. 8th November, 1954. (Cognate application 12333, 28th April, 1954.) (780725.)

1954

4498. Berghaus, B.—Lead-in for electric currents in gas-discharge vessels. 16th February, 1954. (780850.)

9139. British Thomson-Houston Co., Ltd.—Electrical control of winder plants. 23rd February, 1955. (780715.)

10099. British Thomson-Houston Co., Ltd.—Electrical transmission line arrangements. 29th April, 1955. (780804.)

10101. British Thomson-Houston Co., Ltd.—Electric control systems for lifts. 16th March, 1955. (780716.)

10495. Standard Telephones & Cables, Ltd.—Provision of localised attenuation in travelling-wave tubes. 9th April, 1954. (780806.)

12780. Isotope Developments, Ltd., and Eppstein, J. S. B.—Electronic apparatus. 3rd August, 1955. (780736.)

13797. Babcock & Wilcox, Ltd.—Electric igniters for use with fluent fuel burners. 11th May, 1955. (780653.)

14218. General Electric Co., Ltd., and Douglas, R. W.—Thermoelectric refrigerators. 5th August, 1955. (780726.)

15252. Marconi's Wireless Telegraph Co., Ltd.—Apparatus for measuring the length of periodically recurrent pulses. 10th May, 1955. (780738.)

16234. General Electric Co., Ltd.—Electric buzzers, bells and like apparatus. 1st June, 1955. (780740.)

17364. Telefunken Ges.—Circuits for generating sawtooth currents. 14th June, 1954. (780655.)

17403. Igranic Electric Co., Ltd.—Electric resistance welding machines. 14th June, 1954. (780583.)

22514. British Thomson-Houston Co., Ltd.—Voltage stabilising arrangements. 15th July, 1955. (780747.)

31030. General Electric Co.—Ultrasonic testing. 27th October, 1954. (780752.)

32275. Schmitz, E. (trading as Elektro-Schmitz, O. H. G.).—Machines for covering electric conductors with insulation. 8th November, 1954. (780664.)

33184. British Thomson-Houston Co., Ltd.—Electronic audio frequency amplifiers. 16th November, 1955. (780665.)

33394. English Electric Valve Co., Ltd.—Travelling-wave tube arrangements. 25th July, 1955. (780811.)

33397. Marconi's Wireless Telegraph Co., Ltd.—Secret telephone systems. 10th August, 1955. (780866.)

24334. Standard Telephones & Cables, Ltd.—Electric waveguide construction. 26th November, 1954. (780503.)

1955

895. Thorn Electrical Industries, Ltd.—Trans-illuminated panels. 8th December, 1955. (780508.)

1130. Sylvania-Thorn Colour Television Laboratories, Ltd.—Colour television. 18th November, 1955. (780814.)

1205. Gratzmuller, J. L.—Hydraulic control of electric circuit-breakers. 14th January, 1955. (780763.)

2808. Air Preheater Corporation.—Control of electrostatic precipitator current by electrical means. 31st January, 1955. (780609.)

4597. Marconi Instruments, Ltd.—Resistance terminating loading devices. 28th November, 1955. (780516.)

5882. Muirhead & Co., Ltd.—Circuit arrangements for photo-electric multiplier cells. 1st December, 1955. (780817.)

6459. Philips Electrical Industries, Ltd.—Electron microscope apparatus. 4th March, 1955. (780818.)

6638. Muirhead & Co., Ltd.—Thermionic valve oscillators. 7th March, 1955. (780519.)

6731. Ericsson Telephones, Ltd., and Shilling, J.—Electromagnetic vibrator systems. 8th March, 1955. (780615.)

6767. Westinghouse Electric International Co.—Devices for converting X-ray or light images into electric signals. 8th March, 1955. (780819.)

6917. Low & Sons, Ltd., A.—Insulated connectors for electrical conductors. 20th November, 1953. (Divided out of 780702.) (780703.)

8576. Jaffe, B.—Piezoelectric ceramic elements and transducers. 24th March, 1955. (780673.)

10374. Soc. Anon. de Telecommunications.—Equipment for short-wave radio telecommunications. 7th April, 1955. (780768.)

14579. Zenith Radio Corporation.—Electron discharge switching valve. 20th May, 1955. (780531.)

15188. S.U. Carburetter Co., Ltd.—Electrically-operated pumps. 18th April, 1956. (780773.)

19104. Philips Electrical Industries, Ltd.—Cathode-ray tubes. 1st July, 1955. (780827.)

19261. Philips Electrical Industries, Ltd.—Electric glow-discharge apparatus for measuring low gas pressures. 4th July, 1955. (780828.)

20447. General Electric Co.—X-ray microscopes. 14th July, 1955. (780682.)

21704. Licentia Patent-Verwaltungs-Ges.—Method of manufacturing electric asymmetrically conductive systems. 14th August, 1953. (Divided out of 780723.) (780724.)

21769. Loewe, S.—Process and arrangement for undertaking switching measures with tape recorders. 28th July, 1955. (780902.)

24561. Western Electric Co., Inc.—Magnetic core circuits. 26th August, 1955. (780784.)

27059. Norton Grinding Wheel Co., Ltd.—Electrolytic cell. 22nd September, 1955. (780785.)

27892. Standard Telephones & Cables, Ltd.—Static electric switches. 30th September, 1955. (780832.)

32199. Collier, R.—Electrical control systems for heating means. 10th November, 1955. (780559.)

36358. Robertshaw-Fulton Controls Co.—Electric thermal time delay switches. 19th December, 1955. (780641.)

1956

4778. Hoover, Ltd.—Electric irons. 15th February, 1956. (780695.)

6437. Wörner, A., and Ersing, M. (trading as Kautt & Bux).—Electric switch having a slidable actuating button. 1st March, 1956. (780567.)

8837. General Electric Co.—Plant for assembling electrical components. 21st March, 1956. (780921.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 10th August:

No. B763,229 (design). Class 7. Escalators and lifts, and parts.—J. & E. Hall, Ltd., 10, St. Swithin's Lane, London, E.C.4, and Dartford Ironworks, Dartford, Kent.

COROSTAT. No. 739,892. Class 9. Electron discharge tubes (not for lighting purposes).—Electronic Instruments, Ltd., Lower Mortlake Road, Richmond, Surrey.

No. 754,281 (design). Class 9. Electrical and radio apparatus and instruments.—M. E. Becker, Karlsruhe, Germany. Address for service, c/o H. A. L. Venner, 1, Gt. James Street, Bedford Row, London, W.C.1.

AQUEDUST. No. 763,721. Class 9. Electric suction cleaning machines for industrial use, and parts.—Cimex-Fraser Tuson, Ltd., Cray Avenue, Orpington, Kent.

COMET. No. 764,142. Class 9. Radio and television apparatus, radio-gramophones, and apparatus for recording sound by means of magnetic tape.—Dynaport Radio & Television, Ltd., 30-34, Gorst Road, North Acton, London, N.W.10.

HOUSEMASTER. No. 764,240. Class 9. Electric vacuum cleaning apparatus and parts.—Bylock Electric, Ltd. 109, South Street, Enfield, Middx.

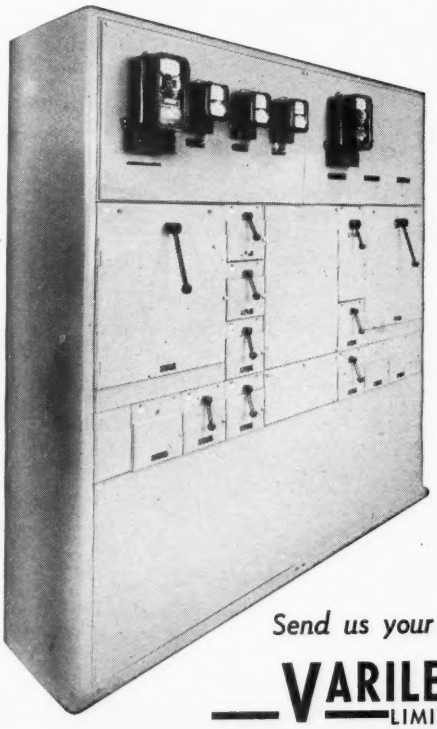
VAGABOND. No. 764,307. CINDERELLA. No. 765,016. Class 9. Radio receiving apparatus and record players.—Vidor, Ltd., 681, Salisbury House, Finsbury Circus and London Wall, London, E.C.2.

TRINELINE. No. 764,730. WIDPLEX. No. 764,731. Class 9. Electrical apparatus and instruments.—C. J. Widmar, 2, Eady Road, Upper Heyford, Oxfordshire.

PLY-O-THENE. No. 764,563. Class 11. Electric torches.—Pifco, Ltd., Pifco House, Watling Street, Manchester, 4.

MODIFORM. No. 765,020. Class 11. Electric light fittings.—Courtney Pope (Electrical), Ltd., Amhurst Park Works, adjacent 341, Seven Sisters Road, Tottenham, N.15.

Cubicle Switchboards



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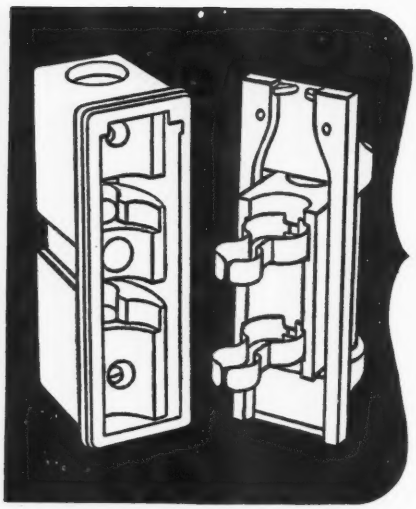

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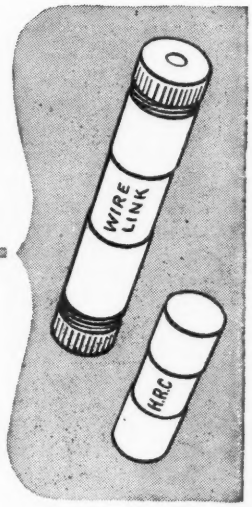

Edward Wilcox & Co. Ltd., Wythenshawe, Manchester 22

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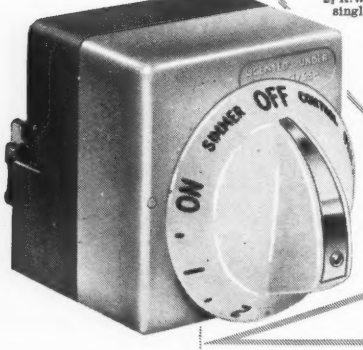
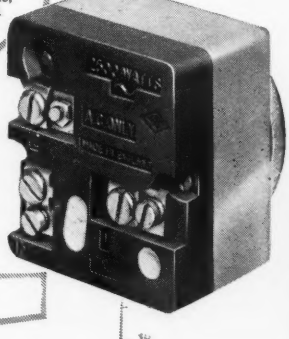
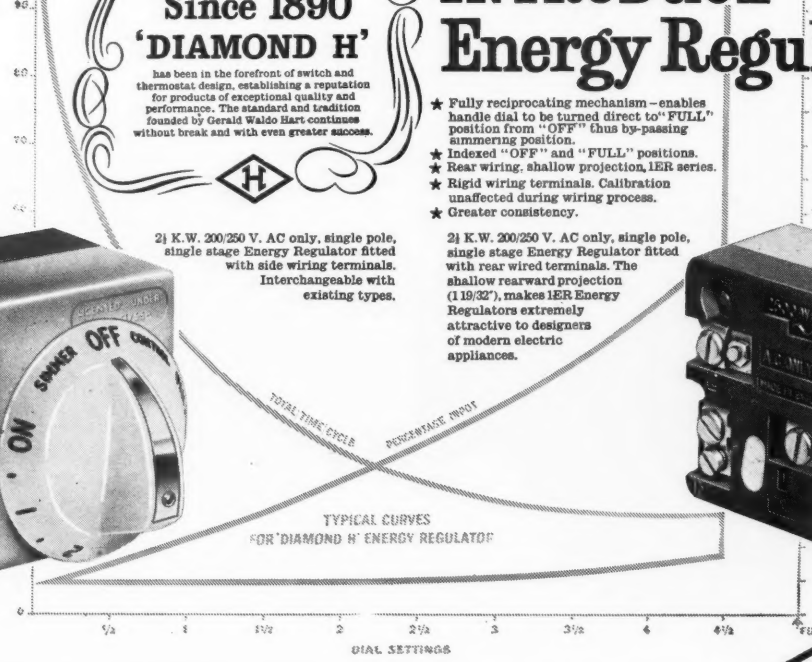
★ Indexed "OFF" and "FULL" positions.
★ Rear wiring, shallow projection, 1ER series.
★ Rigid wiring terminals. Calibration unaffected during wiring process.
★ Greater consistency.

2½ K.W. 200/250 V. AC only, single pole, single stage Energy Regulator fitted with side wiring terminals. Interchangeable with existing types.



2½ K.W. 200/250 V. AC only, single pole, single stage Energy Regulator fitted with rear wired terminals. The shallow rearward projection (1 19/32"), makes 1ER Energy Regulators extremely attractive to designers of modern electric appliances.





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GENERATION AND DEVELOPMENT

Lower All-Electric Flat Operating Costs

The second year's operating figures are now available for the all-electric flats at Kirkcaldy, where one of the first large-scale floor warming installations was carried out. These show a further reduction in costs, as follows: Three-apartment flats, from 14s 3½d per week in 1955-56 to 13s 7½d per week in 1956-57; and two-apartment flats, from 10s 9½d to 9s 4d per week. These average figures cover all the essential heating, cooking, lighting and allied services.

This further decrease is accounted for by the fact that the individual householders had acquired experience of operation of the services and in the second year adjusted them more nearly to their own needs. In the same period there has, of course, been a substantial increase in coal and other costs.

Power from Peat

Assembly of the John Brown gas turbine has begun at Altnabreac, where the North of Scotland Hydro-Electric Board is to carry out experimental work on the generation of electricity from peat. It is planned to carry out the first tests of this turbine towards the end of the year. The Altnabreac site is in Caithness, comparatively near to the Dounreay atomic energy station. The impact of the atomic age on the peat project is something which remains to be determined. In the meantime the intention is to proceed with the work which was planned some four years ago when the Government accepted the proposals of the Scottish Peat Committee that experimental work should be done on peat utilisation with particular reference to power generation.

The Altnabreac site has been the scene of activity for some three years with large scale handling and contracting plant at work to harvest peat by the milling, and air drying process. An annual take-off of 16,000 tons of peat is estimated as a likely volume and this should mean a saving of 4,000 tons of coal. The area is estimated to provide enough peat for 14 years working.

Planning Nuclear Stations

A scheme for better consultation on the planning of nuclear power stations has been put to the Central Electricity Authority by Berkshire County Planning Committee. It urges the Authority to consult "at the earliest possible date" all local planning authorities who may be affected either by the stations now being planned or by the lines which will eventually radiate from these stations. It also wants the Authority to adopt the procedure of simultaneous consultation with all local planning authorities affected.

Pumped Storage Forecast

The construction of more hydro-electric schemes in the North of Scotland to meet the need for pumped storage for the economic operation of nuclear power stations was forecast recently by Sir Donald Perrott, a member of the United Kingdom Atomic Energy Authority, when speaking at the opening of the new Errochty power station, near Pitlochry, Perthshire. He said that pumped storage was the only commercially practical way of "storing" electricity on a large scale at present.

Hydro-electric schemes and nuclear power stations had two common characteristics—high capital cost and low running costs. It was desirable, so far as possible, to operate nuclear stations continuously throughout the year, but only about 15 per cent of the electrical load in the United Kingdom was continuous. A promising possibility was pumped storage. "It is here that it should be possible for nuclear and water power to join forces," Sir Donald said. The prospects of constructing in the North of Scotland in the next two decades a sizeable amount of pumped storage capacity for operation in "double harness" with nuclear power stations seemed good. This would be in addition to normal hydro-electric development.

The Errochty station was officially opened by Mr. John S. Maclay, Secretary of State for Scotland, who said that if the development of power had to be denied for geographical or other reasons, the nation would have reason to look to its future with misgiving.

Mr. Tom Johnston, the chairman of the North of Scotland Hydro-Electric Board, said that a tunnel over six miles long had been constructed to take water to the power station from Loch Errochty.

Street Lighting Plans

Ilkeston General Works Committee has approved the conversion of 330 street lamps, mainly gas, to sodium electric discharge lighting at an estimated cost of £10,900.

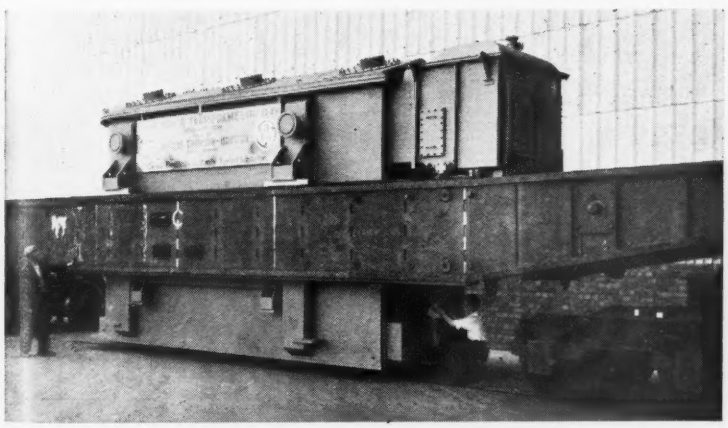
The **Newburn (Northumberland)** Urban District Council has applied for loan sanction for £16,275 for further improvements to electric street lighting.

OVERSEAS

Ceylon Nationalisation Plan Criticised

The Commissioner of Local Government, Ceylon, Mr. V. C. Jayasuriya, has severely criticised the recommendation of Mr. J. G. Parks, Electrical Adviser to the Government, that a public corporation should be established for the generation, transmission and distribution of electricity.

Mr. Jayasuriya, in a memorandum submitted to the Minister of Transport, Mr. Maitripala Senanayake, says that such a root and branch reformation is neither justified nor practicable, and would have serious repercussions on local authorities which are already complaining of unjustified inroads into their spheres of activity. He adds that electricity is the chief public utility service undertaken by local authorities, and it is only fair to say that this has been handled with reasonable efficiency. The failure of the Government to make funds available to local authorities has in no small measure contributed to the lack of improvement schemes. Mr. Jayasuriya declares that in the general interest it is necessary to avoid over-centralisation.



One of two 60 MVA, 132/33 kV transformers being supplied by the British Thomson-Houston Co., Ltd., for Ryeford substation, South Western Division, C.E.A. It is one of the first to be built to the new C.E.A. Specification for close enclosure for sound-proofing, and weighs 106 tons

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Ampthill.—U.D.C. 24th August. Supply and installation of immersion heaters in 62 Council houses. Surveyor, Council Offices, Bedford Street.

Australia.—Director, Posts and Telegraphs, G.P.O., Melbourne. 10th September. Six-tube coaxial cable system. (E.S.B. 17461/57. Ten/27067.)*

Victorian Railways, Melbourne. 14th August. Disc type transmission insulators with metal fittings. (E.S.B. 17957/57. Ten/27117.)* Electric barrier mechanisms for level crossings. (E.S.B. 17956/57. Ten/27137.)*

State Electricity Commission of Queensland, Brisbane. 25th September. One 550-650 kW gas engine-driven generating plant. (E.S.B. 17375/57. Ten/27093.)*

Basingstoke.—Park Prewett Group Hospital Management Committee. 30th August. Supply of electric lamps (Schedule No. 6) for the six months from 1st October, 1957. F. Hales, group secretary, Basingstoke, Hants.

Cambridge.—City Council. 31st August. Electric lamps (Schedule No. 8), for one year from 1st October next. City engineer, Guildhall.

Cornwall.—County Council. Contractors wishing to tender for electrical services in connection with new schools should apply by 10th August. (See this issue.)

Coseley.—U.D.C. 19th August. Street lighting equipment. (See this issue.)

Fife.—County Council. 31st August. Street lighting equipment. (See this issue.)

Formosa.—Central Trust of China, Taipei. 13th August. Air circuit-breakers. (E.S.B. 17711/57.I.C.A. Ten/27055.)*

Hendon.—Borough Council. 21st August. Electrical fittings (Form No. 6), for the period ending 30th September, 1958. Borough engineer, Town Hall, Hendon, N.W.4.

India.—Director General of Supplies and Disposals, New Delhi. 14th August. Enamelled copper wire. (E.S.B. 18066/57. Ten/27145.)* 21st August. Insulated copper cadmium wire. (E.S.B. 18070/57. Ten/27153.)*

Iran.—Ministry of War. 10th August. Electric furnace and stainless steel drums. (E.S.B. 17811/57. Ten/27079.)*

Plan Organisation, Tehran. 17th August. Electrical equipment for a number of towns. (E.S.B. 17854/57. Ten/27138.)*

Sherkat Sahami Karkhanejat Ghand, Tehran. 20th August. Four 150 kW diesel generator sets. (E.S.B. 17434/57. Ten/27163.)*

Morley.—Corporation. 19th August. Street lighting equipment. (See this issue.)

New Zealand. — State Hydro-Electric Department, Wellington. Five 20,000 kW gas turbine driven generating sets. (E.S.B. 18017/57. Ten/27171.)*

G.P.O., Wellington. 7th August. Fuses. (E.S.B. 17634/57. Ten/27075.)* 22nd August. Lamp jacks. (E.S.B. 17281/57. Ten/27076.)* 27th August. Fuses. (E.S.B. 17750/57. Ten/27057.)*

Wellington Electricity Department, 26th August. P.v.c. covered copper cable. (E.S.B. 17959/57. Ten/27141.)*

Dunedin Electricity Department. 21st August. Transformers ranging from 15 kVA to 1,000 kVA. (E.S.B. 17749/57. Ten/27066.)*

Pakistan.—Posts and Telegraphs Department, Karachi. 10th August. Three 2·5-2·7 kVA rotary convertors. (E.S.B. 17533/57. Ten/27116.)*

Salford.—Corporation. 10th September. Rewiring of electrical installation at the Weaste depot. (See this issue.)

Slough.—Borough Council. 20th August. Three submersible motor type electric pumps. Borough engineer, Town Hall.

Solihull.—Corporation. 23rd August. Street lighting equipment. (See this issue.)

Ware.—U.D.C. 19th August. Installation of class "A" street lighting. A. G. Davenport, surveyor, The Priory.

Warwickshire.—County Council. Firms wishing to be placed on a list of approved contractors for heating, etc., services and electric lighting and power installations should apply by 2nd September. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Hartlepool.—Corporation. Installation of electricity in 118 new houses at King Oswy Drive (£2,498).—E. Dixon Barker & Son.

Leeds.—City Council. Recommended. Electric lighting installations in 126 dwellings at the Butcher Hill and Tinshill estates (£3,035).—B.C.S. Electrics. Electrical installation work at blind persons' hostel, Moortown (£2,452).—Vallance & Davidson.

Newcastle-on-Tyne. — Regional Hospital Board. Electrical work at operating theatre suite, Thorpe Maternity Hospital (£1,676).—Steels Engineering Installations. Electrical installation at new accident wing at Middlesbrough General Hospital (£35,173).—A. Anderson & Son. Engineering services at Prudhoe and Monkton Hospital (£18,895).—Veale-Nixon.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aldershot.—New town hall proposed, Warburg Barracks site; borough engineer, Municipal Buildings.

Barnstaple.—Bus station, North Walk, for Southern National Omnibus Co., Ltd.; A. A. Briggs, architect, Tilling Association, 10, Fleet Street, London, E.C.4.

Billingham-on-Tees. — Three-storey flats, Billingham Green; U.D.C. surveyor.

Birmingham.—Fourteen-storey office block, Edmund Street; Frank Smith, Wilson & Co., surveyors, 37, Temple Street.

Works, Stanhope Street; H. E. Hazlehurst, Ltd., 168, Darwin Street.

Cambridge.—Stages 3 and 4 of chemistry laboratories for University; R. T. James & Partners, consultants, 6, Lower Grosvenor Place, London, S.W.1.

Cardiff.—Printing works and offices, Wood Street; Western Mail & Echo, Ltd., Kemsley House, St. Mary Street.

Carlisle.—Warehouse and offices, Lancaster Street/King Street site; Ridley (Wholesale Chemists), Ltd., Collier Lane.

Cottesmore.—Primary school (£25,000); architect, Catmose, Oakham, Rutland.

Cumberland.—New secondary schools at Distington, Longtown, Penrith and Egremont, and additions to Stoneraise Primary School; county architect, Portland Square, Carlisle.

Eastbourne.—Factory, Brampton Road trading estate; Hotchkiss Engineering Co., Ltd., 33, Terminus Place.

Glenrothes.—Factory, Queensway industrial estate; P. Tinto, planning officer, Woodside, Glenrothes, Markinch, Fife.

Haverfordwest.—Dwellings (74), on site off St. David's Road; borough engineer, 9, Victoria Place.

Hillingdon.—First instalment of scheme for rebuilding Hillingdon Hospital (£300,000) for North West Metropolitan Regional Hospital Board; W. S. Try, Ltd., building contractors, High Street, Cowley.

Huddersfield.—Girls' grammar technical school, Salendine Nook (£278,169) and maisonnettes and bungalows, Rashcliffe Hill (£108,393); borough architect, High Street Buildings.

Hull.—Works extensions; Universal Oil Co., Ltd., Stoneferry.

Ilford.—Three-storey block of flats, Madras Road; borough engineer, Town Hall.

London.—Dwellings (201), Canterbury Crescent; Co-operative Planning, 73b, South Side, Clapham Common, S.W.4.

Outpatients' department for Putney Hospital; Hammett & Norton, architects, 29, Sackville Street, W.1.

Printing works for Samuel Stephen, Ltd., Belvedere Road, Norwood; Truett & Steel, Ltd., builders, 71, High Street, Thornton Heath.

Middlesbrough.—Modernising and extending annexe at Middlesbrough Maternity Hospital for Newcastle Hospital Board, Benfield Road, Newcastle-on-Tyne (£60,000); P. H. Knighton, Board's chief architect.

North Shields.—New stores, Little Bedford Street; F. W. Woolworth & Co., Ltd., 1, New Bond Street, London, W.1.

Portsmouth.—Radiological and radiotherapy department for St. Mary's Hospital; Thomas K. Makins, architect, 4, Landport Terrace.

Reading. — Tilehurst Primary School (£47,000), and extensions to Kendrick Girls' School (£30,000); town clerk, Town Hall.

Scunthorpe.—Grammar/technical school; county architect, Lincoln.

Sheffield.—Three thirteen-storey blocks of flats, Herdings estate; city architect.

Secondary school, Lyers Grove; Ackroyd & Abbott, Ltd., builders, 47, Willoughby Street.

South Moor (Co. Durham).—Rebuilding of the Tivoli Cinema for M.B.C. Cinemas, Ltd.; N. M. Phillips, architect, 43, Oxford Street, Workington.

Sunderland. — Housing development scheme in the Azalea Terrace area (£89,000); R. Matthews and Co., builders, Villiers Street.

Additions to Technical College, West Park (£186,000); G. H. Plemper, Ltd., builders, Old Chester Road.

Tynemouth. — Proposed civic centre; borough engineer, 16, Northumberland Square, North Shields.

Wakefield. — Crematorium, Crigglestone Cemetery; city engineer.

Office block; Fell Construction Co., Ltd., 20-30, Lawefield Lane.

Waltham Abbey.—King Harold Secondary School (£107,000); H. Conolly, county architect, County Hall, Chelmsford.

West Hartlepool.—Offices for the South Durham Steel & Iron Co., Ltd.; Dodge & Reid, architects, 72, High Street, Brentford.

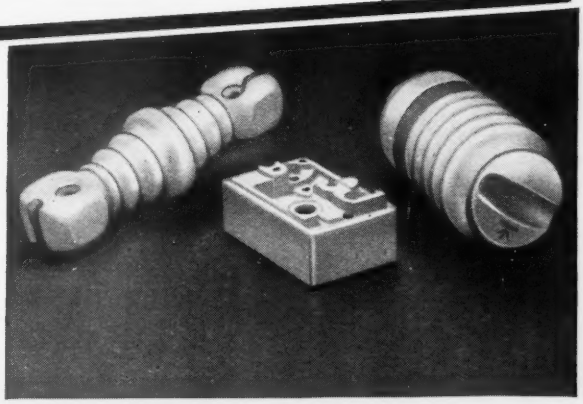
Houses (70) and flats (40), Owton Manor estate; A. G. Sinclair, borough architect.

York.—Bank and offices, Bootham & Gillygate; Midland Bank, Ltd., Poultry, London, E.C.2.

Factory extension; British Sugar Corporation, Ltd., Boroughbridge Road.

Bullers CERAMICS

FOR INDUSTRY



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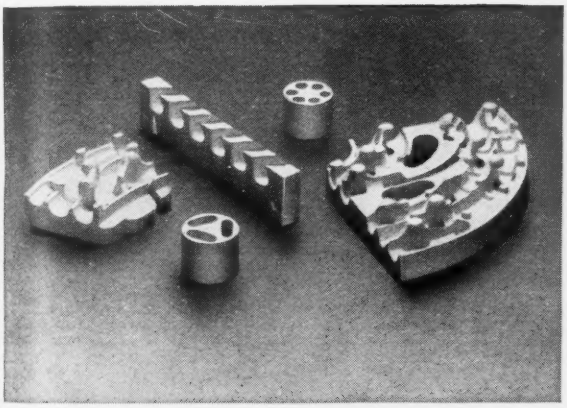

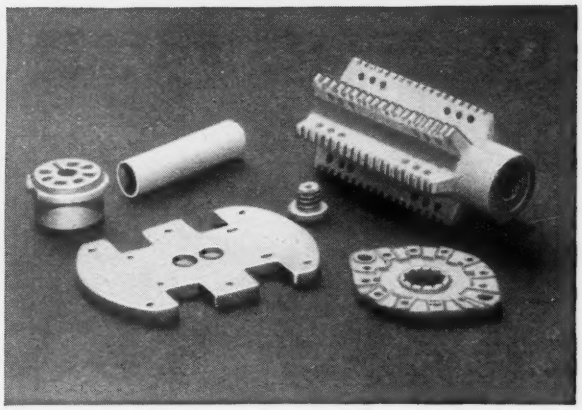

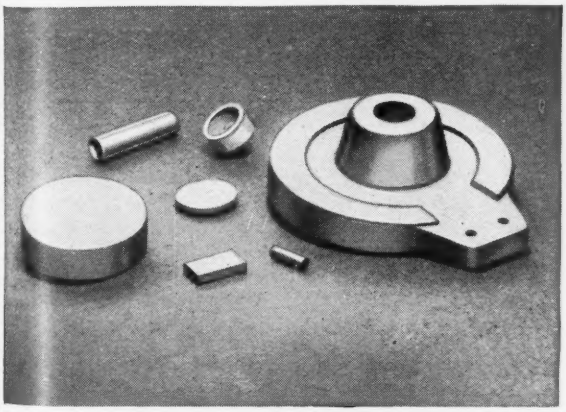

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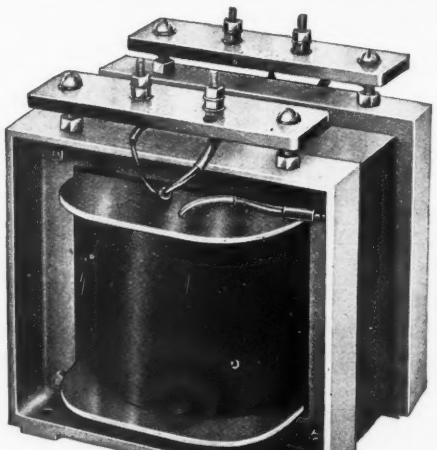

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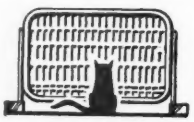

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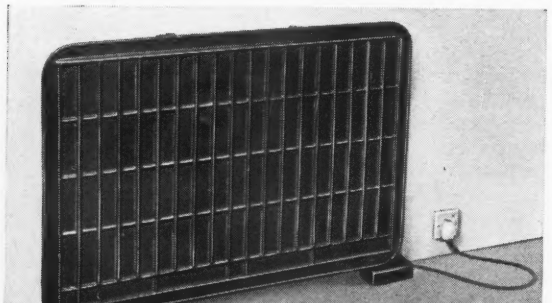

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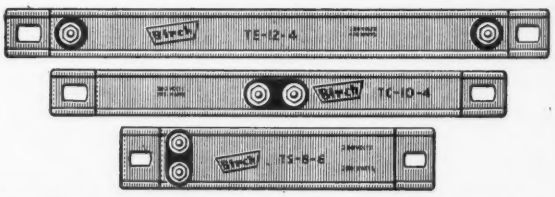

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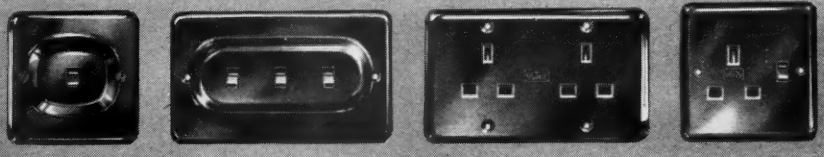

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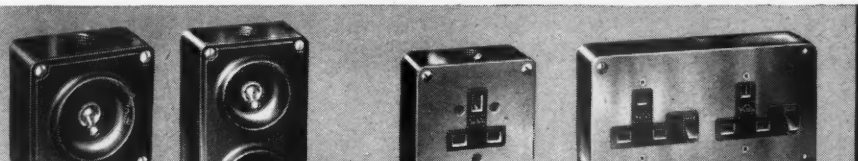

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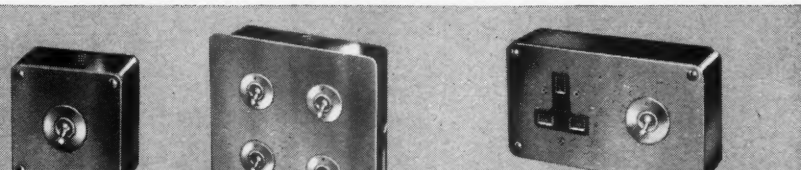

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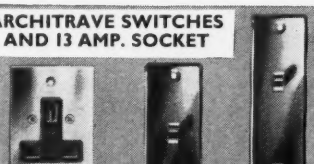

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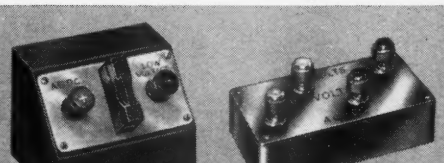

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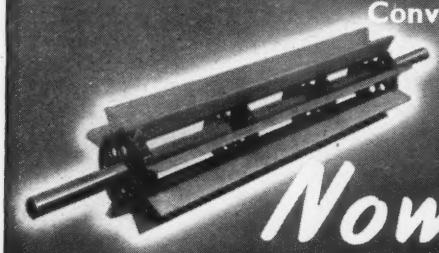

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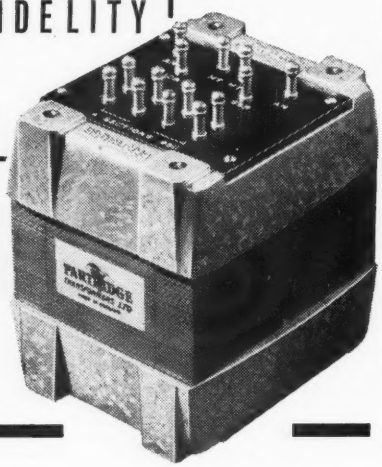

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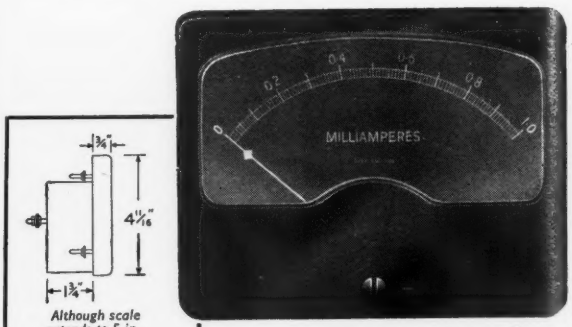

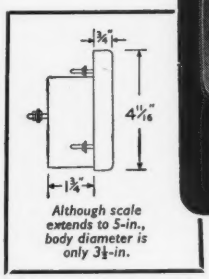

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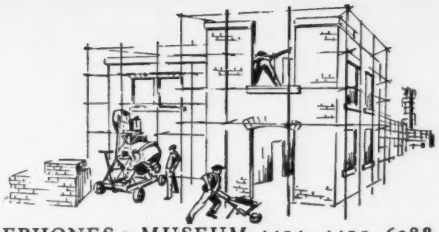

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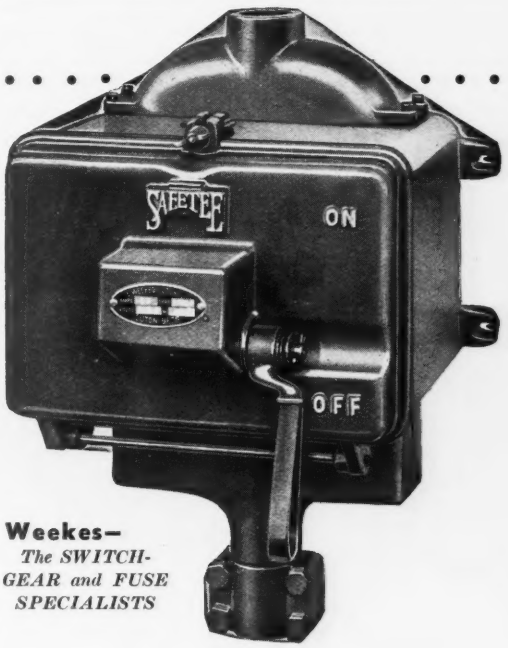

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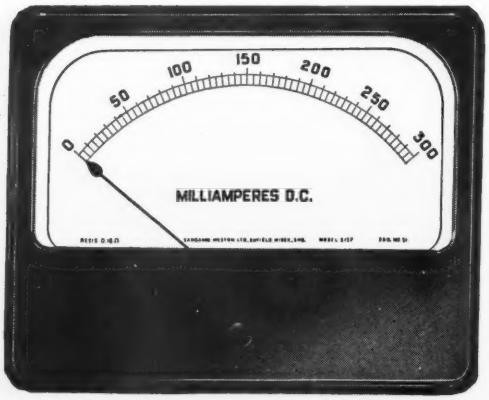

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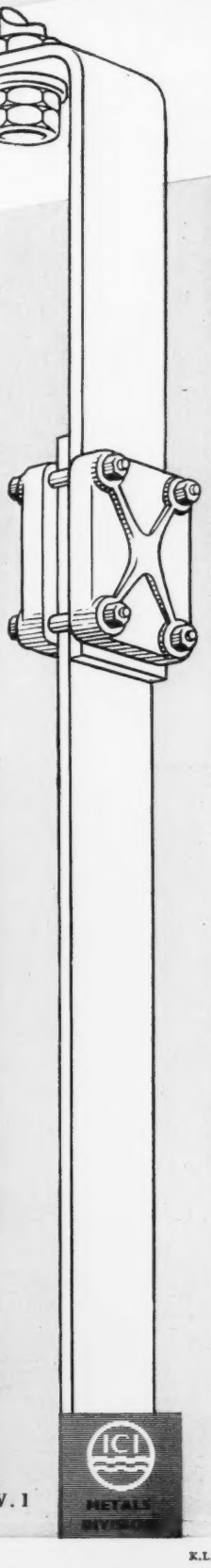

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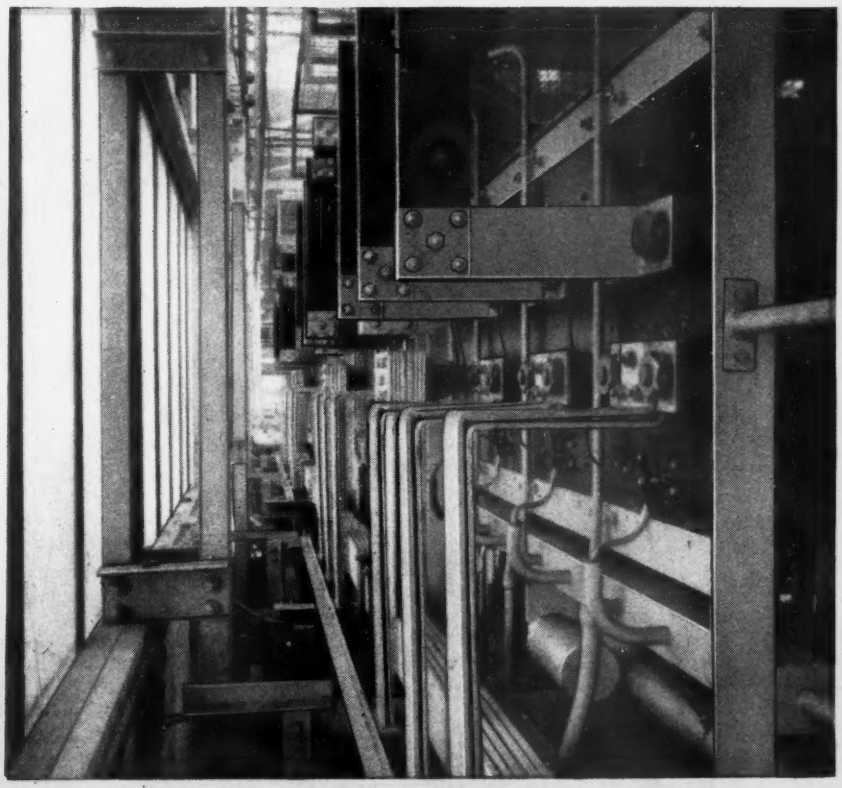

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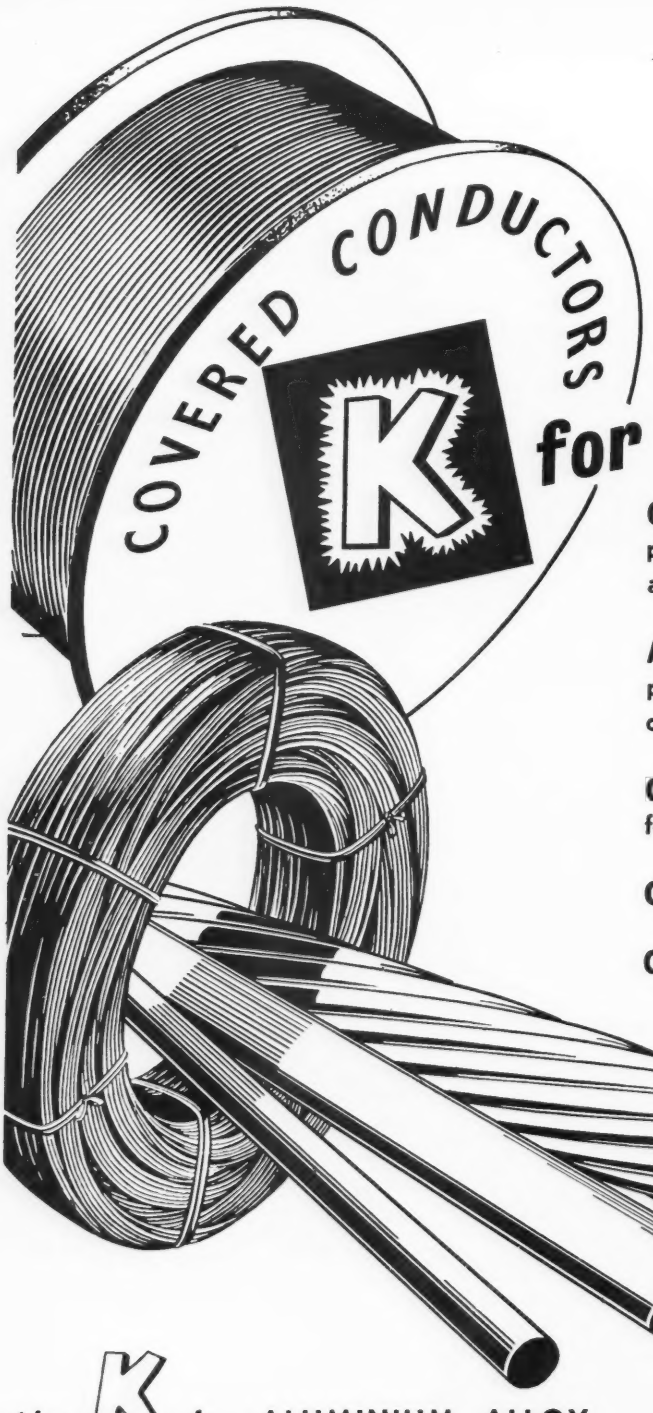

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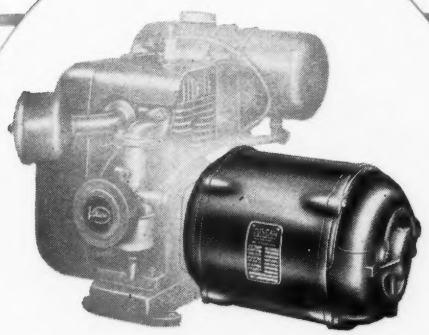

500 Watt Close Coupled Battery Charging Generator

ALTERNATORS & D.C. GENERATORS

CLOSE COUPLED TYPE FOR ALL MAKES OF ENGINES OR FOOT MOUNTED 0.25 - 3 kVA

Alternadores y generadores de c.c. De tipo de acoplamiento compacto para todas las marcas de motores o de montaje sobre pies. De 0,25 a 3 kVA.

LET TUSCAN PROVIDE THE POWER

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Precision

TURNED FASTENERS

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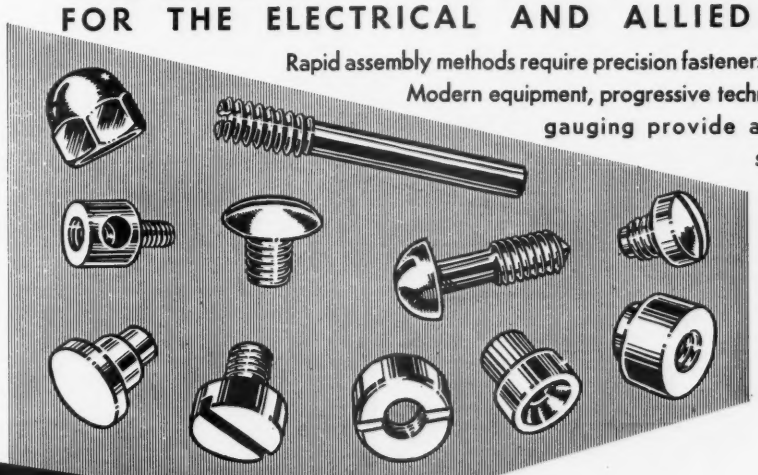
ALL AUTOMATIC AND CAPSTAN TURNED PRODUCTS

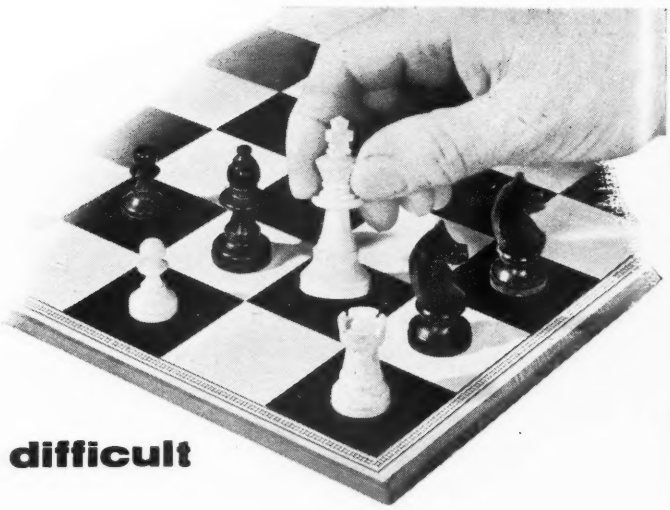
STOCKS of standard turned screws available for immediate use

Rapid assembly methods require precision fasteners and components. Modern equipment, progressive technique, and quality gauging provide an unsurpassed specialist service.



VERNIER

MANUFACTURING CO. LTD.
Garman Road, London, N.17
Telephone: Tottenham 5077



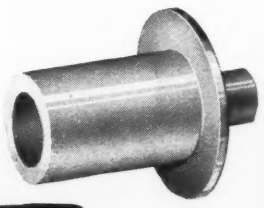
The choice is often difficult

Take the matter of Die Castings vs. Hot Pressings. Each method has its own advantages for producing dimensionally accurate components.

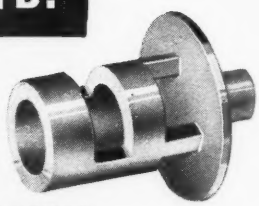
DIE CASTINGS in Brass, Bronze or Aluminium, cut costs by the reduction of machining and finishing operations and by the virtual elimination of machining allowances.

BRASS PRESSINGS, again, can be produced so rapidly that, in many cases, the nett unit cost is lower by this method than any other.

The problem, therefore, is to choose the most suitable and economical process for YOUR specific needs. And that is where we at the Non-Ferrous Die Casting Company can help: we can advise you well for we make *both* . . . Together with our associate company, Brass Pressings (London) Ltd., we conduct joint operations under one roof, sharing administrative and technical personnel, and the same metallurgical laboratories. Our recommendations to you are therefore sound and unbiased.



BRASS PRESSINGS (LONDON) LTD.



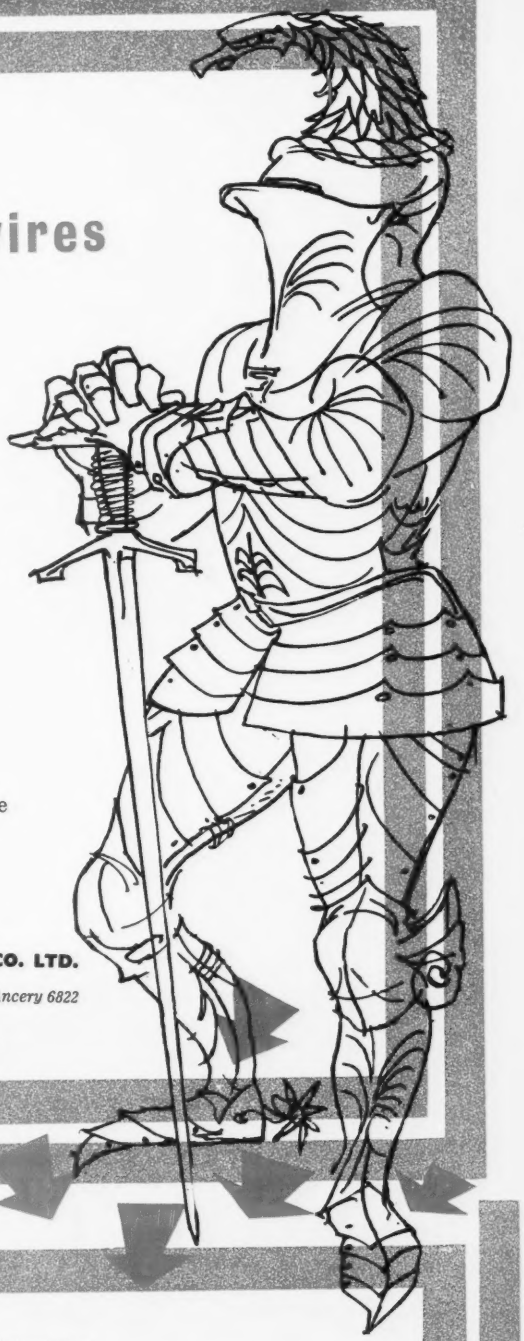
Remember, whenever you require a constant or phased supply of dimensionally accurate parts in Brass, Bronze or Aluminium — contact us *first*. Should you wish, we will be pleased to send a Technical Representative to discuss your problem.

THE NON-FERROUS DIE CASTING CO., LTD.

Nonferdica Works, North Circular Road, London, N.W.2. Telephone: GLAdstone 6377

45

equipment wires



Conforming to
SPECIFICATION DEF. 12, 1953

Henley Equipment Wires
are extremely resistant to all forms
of insect and chemical attack.
The P.V.C. compound has good heat
ageing properties, which combine
with good abrasion resistance,
elasticity and tensile strength.
Large stocks of the standard colours
and also stripe marked varieties are
available for prompt despatch.
Industry and Contractors can rely on the
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51-53 Hatton Garden, London, E.C.1 *Telephone: CHAncery 6822*

Resistant to:

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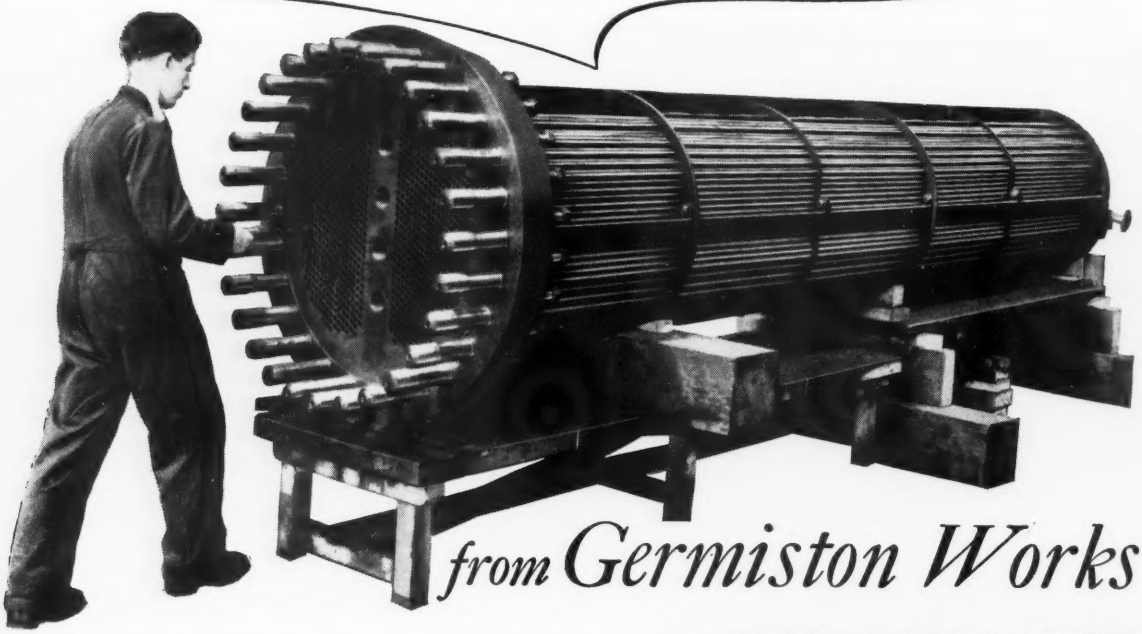
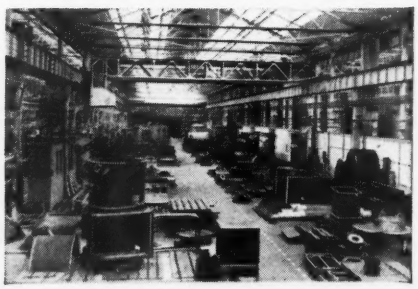
BY APPOINTMENT TO
HER MAJESTY THE QUEEN
ELECTRIC CABLE
MANUFACTURERS

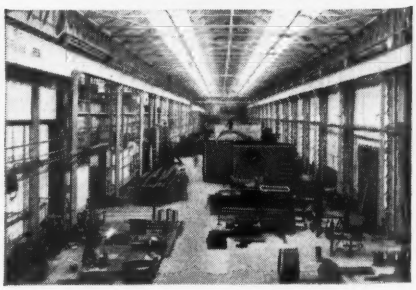
Heat Exchange Equipment



from Germiston Works

Expanding heater tubes at Germiston Works. This factory has 160,000 *sq. ft. of floor space in four bays. General views of Nos.* 3 & 4 *bays are shown.*





Metropolitan-Vickers is one of the principal British manufacturers of heat exchange equipment for use with steam and gas turbine plant. The company's production resources were considerably extended by the acquisition in 1952 of the Germiston Works in Glasgow. This factory specialises in the production of all types of heat exchange equipment for thermal power plant.

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ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

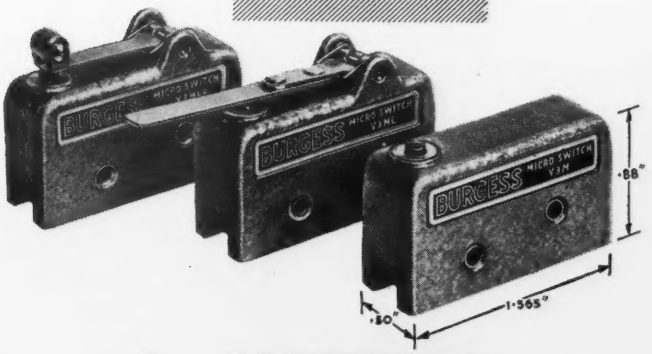
An A.E.I. Company

CONDENSERS FEED WATER HEATERS · DEAERATORS · EVAPORATORS · AUXILIARY EQUIPMENT

POWER PLANT BY METROPOLITAN-VICKERS

B/A 601

A new conception of Precision in Micro Switchcraft..

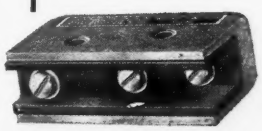


The V3M range of Metalclad Miniature Micro Switches by

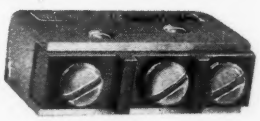
BURGESS

THE BRITISH SPECIALISTS

Details in Folder MS21/5



Two Types of Terminal Arrange-ments



BURGESS PRODUCTS COMPANY LTD
MICRO SWITCH DIVISION
DUKES WAY, TEAM VALLEY, GATESHEAD 11
Telephone: Low Fell 75322 (3 lines) Telex: 53-229

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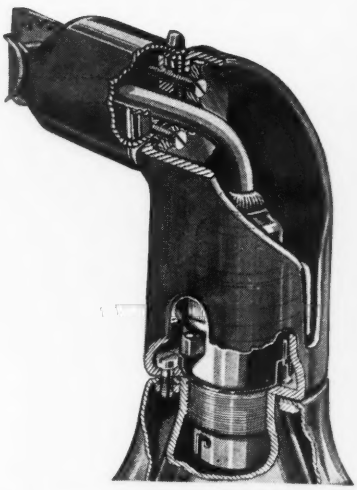
INDUSTRIAL LIGHTING UNITS



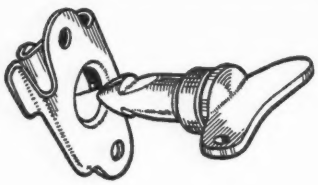
Catalogue sent free on request

The Swivelling Head carries the reflector and protects the lampholder from accidental damage, openings being provided for access to the push-bar. "Sudsproof" and "Edison Screw" types are also available. Six sizes of reflector.

Various lengths of arm (maximum horizontal reach 54 in.). With pillar or short vertical pivot. Bases for wall, bench, ceiling, floor or for mounting direct on machines. Also portable types.

MEK-ELEK Engineering Ltd., 17 Western Road, Mitcham, Surrey
Phone: MITcham 3072 Cables: Mekelek, London

ODDIE FASTENERS



The Fastener with endless applications. Simple, Positive, Self-locking. Made in a variety of types and sizes.

Special Fasteners to suit customers' requirements

WIDELY USED IN THE ELECTRICAL AND RADIO INDUSTRY

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Manufacturers of

ELECTRICAL WELLSTEAD INSULATION

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PRESSPAHN, LTD - BRADFORD - YORKS

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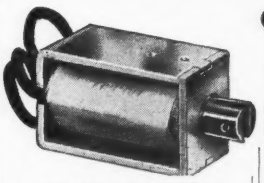


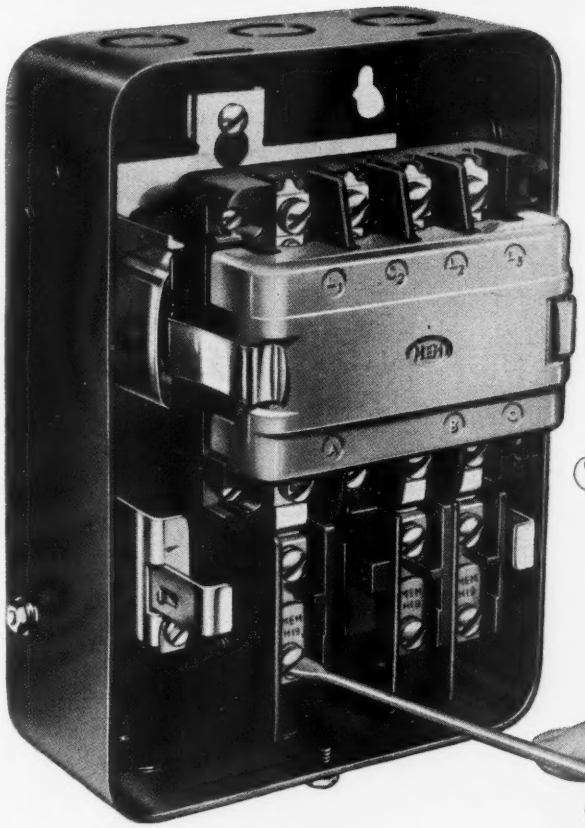
QUICK DELIVERY
Solenoids are normally despatched same day as receipt of order.

PHIL-TROL SOLENOIDS

Range covers types 41 and 42 (front 1" × 1¼") 38, 39 and 40 (front 1¼" × 1¾") and power A.C. and D.C. sizes up to 60 inch-lbs.

6 v-460 v A.C. and D.C. types

PHILLIPS CONTROL (G.B.), LTD.
Farnborough, HANTS. *Telephone: Farnborough 1120*



Standardise on MEM *Autoline* Starters

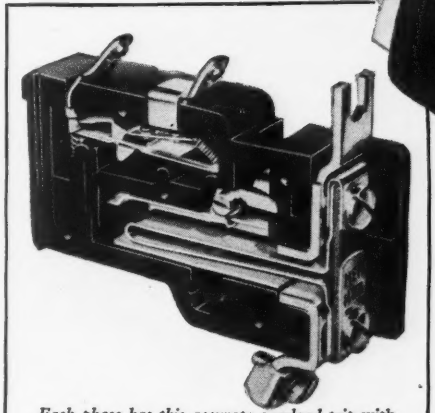
FOR EVERY MOTOR UP TO 15 HP

JUST FIT THE RIGHT HEATER FOR MATCHED OVERLOAD PROTECTION

STOCK the basic MEM Autoline starter and a selection of heaters. When you need a new starter fit the right heater—it's only a moment's work—and you have a starter matched to the duty. You simplify the stores problem and save time and money.

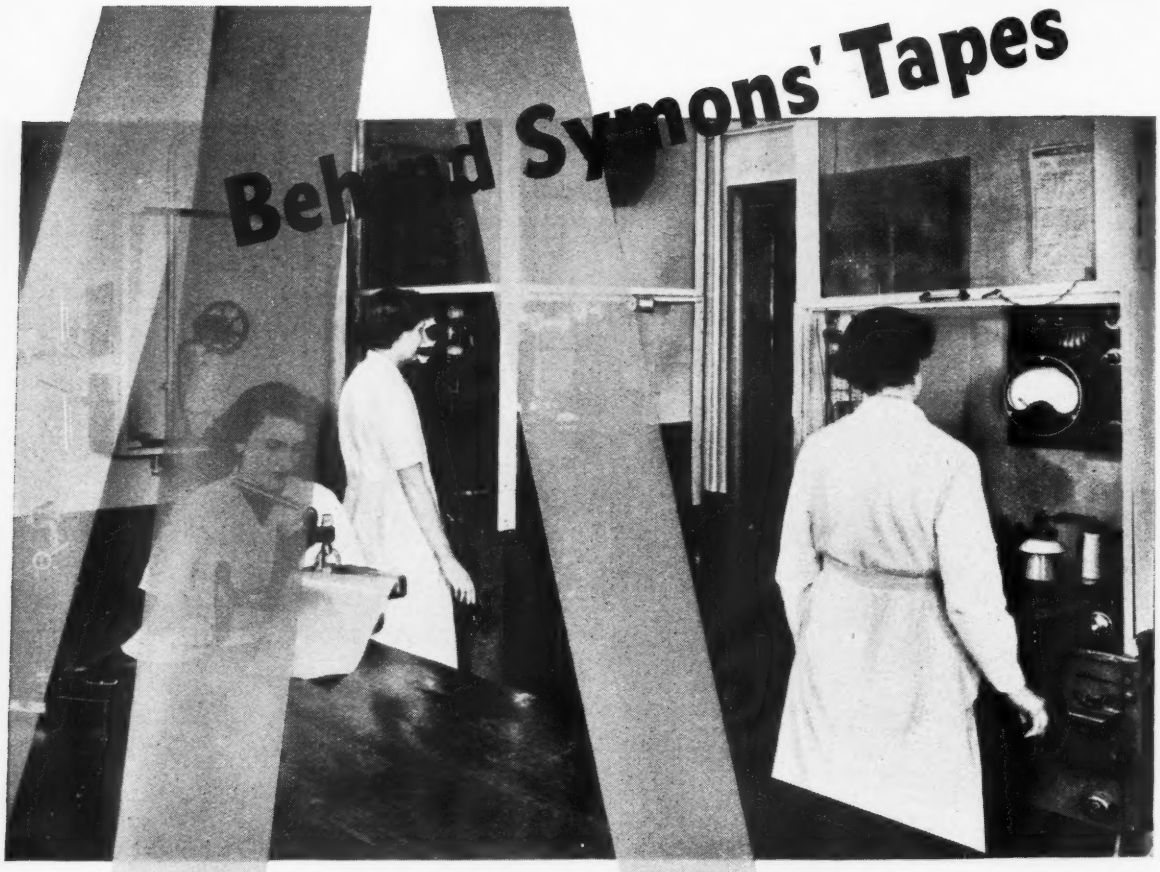
MEM Autoline starters give precision protection for every motor up to 15 HP. This means fewer hold-ups and less loss of plant working time.

Standardising on Autoline starters also makes maintenance easier. All parts are interchangeable. Send for List No. 365(X), describing the Autoline system in detail.



Each phase has this accurate overload trip with a separate switch with solid silver contacts.

MEM MIDLAND ELECTRIC MANUFACTURING COMPANY LIMITED · TYSELEY · BIRMINGHAM 11 · ENGLAND



Behind Symons' Tapes

is this electrical & mechanical test section

To meet the exacting demands of the electrical industry, Symons' flexible insulating materials are subjected to thorough tests before leaving the factory. This special section of the Symons' organisation is responsible for ensuring that our high standard of quality is maintained.

If you have an insulating problem send it to Symons Advisory Service

H. D. SYMONS & CO. LTD.

Park Works · Kingston Hill · Surrey *Tel*: Kingston 0091
Grams: Insulation (Phone) Kingston-on-Thames

Our products include Varnished fabrics, "Duply", "Emlin", "Symax", and "Symica" slot insulations, "Symel" Silicone Elastomer Impregnated and Coated Glass Fabrics. Our sleevings include "Symel" extruded Silicone Elastomer, "Symite" Rolled Varnished Fabric High Tension Sleeving, Varnished Cotton Sleeving and P.V.C.

The METROVICK 950 Digital Computer

FOR MORE RELIABILITY IN COMPUTING

This new computer incorporates :—

FULLY TRANSISTORISED LOGICAL CIRCUITS
PLUG-IN PRINTED CIRCUIT BOARDS

These features in the Metrovick 950 make for—

- RELIABILITY
- EASY SERVICING
- COMPACTNESS
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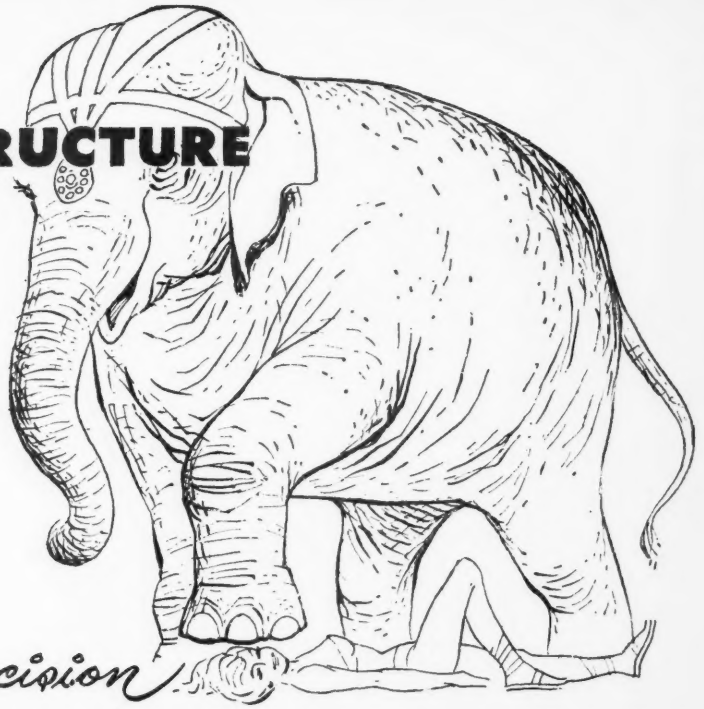
ELECTRICAL CO. LTD. TRAFFORD PARK MANCHESTER 17

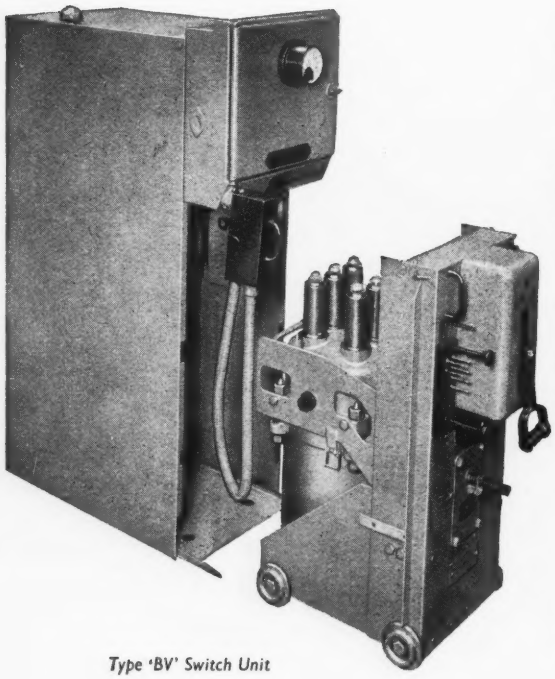
An A.E.I. Company

R/E704

ROBUST STRUCTURE



Delicate precision

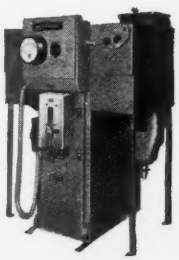


Type 'BV' Switch Unit

The combination of qualities displayed by the circus performers in our pictorial analogy is similar to that called for in Switchgear production, for in Engineering, as in Entertainment, constant effort combined with experience is needed when the common aim is "a satisfactory performance".

ROBUST STRUCTURE is evident in all "Ferguson Pailin" products. This quality, coupled with that equally important characteristic, PRECISION (as applied to the manufacture of components) is essential, for a satisfactory performance in service depends on good design and workmanship.

A striking example of these qualities is illustrated by the "Ferguson Pailin" BV Unit, designed for 11 kV service. This class of switchgear is, in its own category, a household word to most of those engaged in the business of 'power supply' : to those unfamiliar with its virtues, we will be glad to supply full information.



A good example of the adaptability of the "BV" unit is shown here, where it is linked in service with Oil Switch equipment.

Ferguson Pailin LIMITED *for Switchgear*

An A.E.I. Company

Head Office & Works: **HR. OPENSHAW MANCHESTER 11,** *Telephone :* DROylsden 1301 (Pte.Branch Ex)

LONDON OFFICE : Bush House, Aldwych, W.C.2 BIRMINGHAM OFFICE : Windsor House, 656 Chester Road, Erdington, 23 GLASGOW OFFICE : Central Chambers, 109 Hope Street, C.2.

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CABLE of *Quality*

WANDLE BRITISH MADE CABLE

V.I.R. Taped and Braided; Tough Rubber; Lead Covered and Flexibles

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Porcelain Lamp Holders

There are 16 different types available. Details of these and numerous other Tunion Electrical Accessories are included in our CATALOGUE No. 1453 ER (34 pages with 274 illustrations). Why not send for a copy?

Can be supplied to take B.C. Lamps.

TM 98 B.C. Batten 1¼" fixing centres.

TM 114* E.S. Weather-proof type with loose skirt.

TM 341 B.C. Batten large base 2" centres.

TM 134* E.S. Screwed type. Sizes ¾" gas, ¾" Conduit.

GEORGE TURNOCK LTD.

TUNION WORKS NAVIGATION STREET

WALSALL STAFFS

Telephone: Walsall 4966

The APPELBE "BULB FIXER"

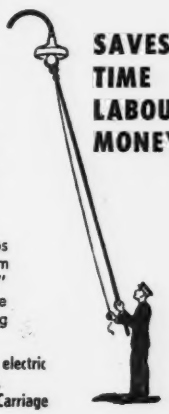
NO LADDERS REQUIRED

Telescopic appliance for fixing and removing electric bulbs. Any reasonable height can be reached.

Made of Aluminium and can be carried with ease on any cycle.

STANDARD MODEL
for 60 to 200 watt lamps at 16' 6" from ground. 6' 0" closed. 12' 0" extended. Weight 3 lb. Cycle clips and Extension Tubing supplied.

"A" MODEL
for 200 to 500 watt lamps E.S. Caps at 20' 0" from ground. 7' 0" closed. 16' 6" extended. Weight 5½ lb. Cycle clips and Extension Tubing supplied.



SAVES TIME LABOUR MONEY

Used by the leading corporation and electric light companies throughout the world. Prices and particulars on request. Carriage Paid in Great Britain.

J. F. APPELBE & CO. LTD.

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Telephone 33522, 31212 and 8725. Telegraphic Address: "Appelbeco, Hull"

If you need

a small **METAL PRESSING** for your product, why not consult us?

We specialise in light precision presswork in all metals for the Electrical Trades.

QUOTATIONS BY RETURN

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80-81 Bath Street, Birmingham 4. *Phone: CENTRAL 2492*

Careers in Electricity

This is an extract from a recorded interview with E. O. Maxwell, an established C.E.A. engineer, aged 26.

"...in Power Stations I could get variety and responsibility"

Q.M.: **What first made you come into the Industry?**

Mr. Maxwell: I saw an advertisement for graduate training and it struck me that in power stations I could get the type of experience I wanted—variety and responsibility.

Q.M.: **Any particular reason why you chose this part of the world?**

Mr. Maxwell: Only that my people were living in the South of England so I voted to do my training here.

Q.M.: **After your training . . .?**

Mr. Maxwell: I was appointed Assistant Engineer—plant testing—Croydon B. My first ambition, of course, was to be in charge of a shift.

Q.M.: **Which you were. Weren't you a Charge Engineer before you were 23?**

Mr. Maxwell: Yes. Assistant two years and two months, then Charge Engineer. I was very keen on being responsible for staff and it suited me fine.

Q.M.: **What are your plans now?**

Mr. Maxwell: Well, my plan at the moment is to gain as much experience of the design and construction—construction side mainly—of nuclear power stations. Actually I shall be going, for two years, to one of the Atomic groups in about four weeks' time. My ultimate aim is really to get back into power stations.

Q.M.: **You don't see yourself spending all your time in a nuclear power station?**

Mr. Maxwell: Oh, no. I'm much too young at the moment to specialise. I want to get as much general experience as I can.

We'd like to publish more of this interview, but there isn't space. For details of the many careers in Electricity Supply, and the salaried training schemes available, please write to:

The Education and Training Officer,
Central Electricity Authority,
12 Winsley Street,
London, W.1.

CEA

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Fluvent

EFFICIENT DISTRIBUTION

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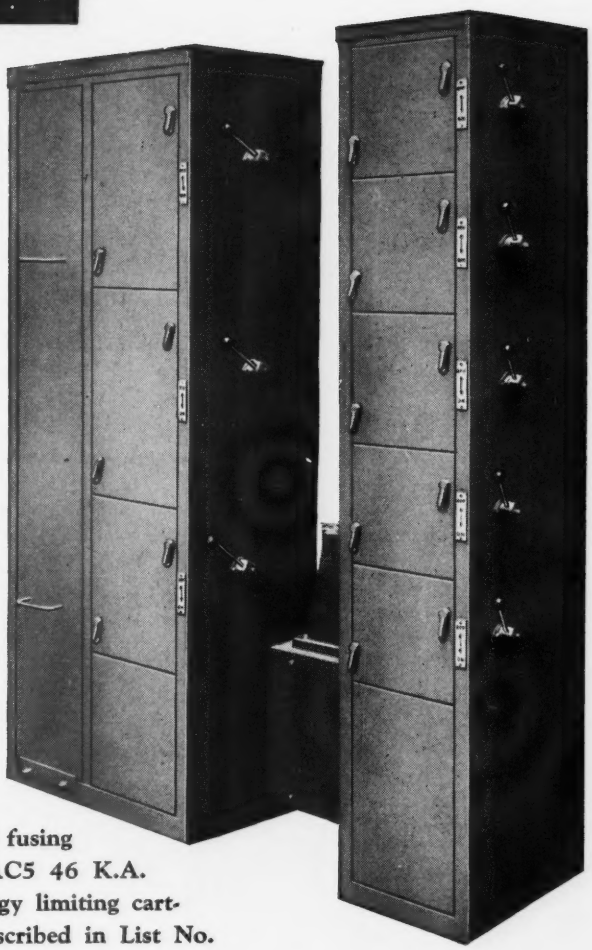

Aeroflex Class P 1.25 fusing factor, category 440 AC5 46 K.A. breaking capacity energy limiting cartridge fuse links, as described in List No. CF2, are now supplied in all standard Aeroflex-Fluvent gear, including *the new Fluvent Power Pillars* which are fully described in List No. PP1

Parmiter Hope & Sugden Ltd

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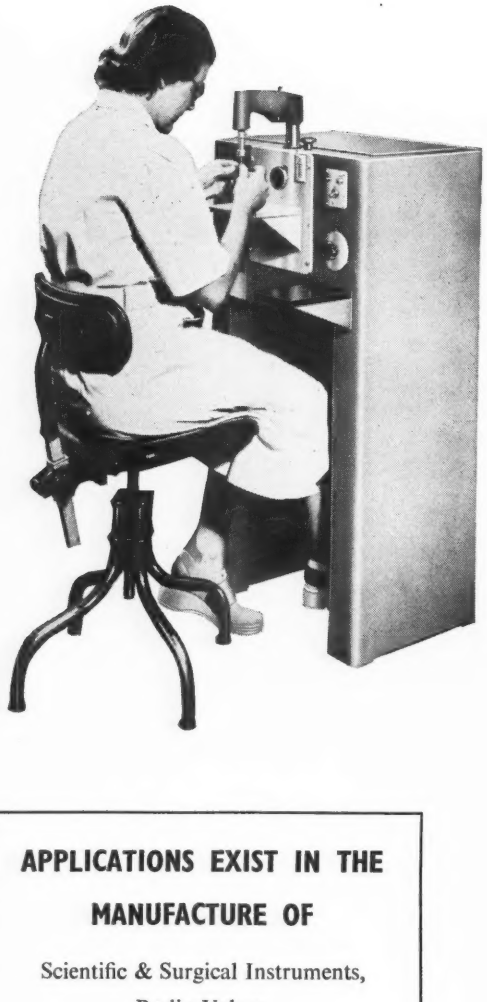
LONDON: 34 Victoria Street, S.W.1. *GLASGOW: 5 Somerset Place, C.3.* *BIRMINGHAM: Carrs Lane 4.*

dmPH110

precision spot welding

. . . of very thin sheets and wires



- ACCURATELY CONTROLLED WELDING TIMES
- SYNCHRONISED TIMING
- CURRENT AND PRESSURE CONTINUOUSLY VARIABLE
- LOW INERTIA ELECTRODE HOLDER
- GRADUATED CONTROLS
- FOOT OPERATED WELD SWITCH
- WELD INDICATOR
- STRAIGHT LINE ELECTRODE MOTION

APPLICATIONS EXIST IN THE MANUFACTURE OF

Scientific & Surgical Instruments,
Radio Valves,
Watches, Jewellery, Lamps
and a wide variety of small components

G.E.C.

4kVA electronically controlled

spot welder

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

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9th AUGUST ISSUE

ADVERTISEMENTS for the above issue have now closed for press

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addresssed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

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WARWICKSHIRE COUNTY COUNCIL

To Heating and Electrical Engineers

FIRMS desirous of having their names placed upon a list of approved contractors from whom the Warwickshire County Council will invite tenders for schemes costing £1,250 and over for :—

1. Heating, hot and cold water supplies, gas and steam services, and/or
2. Electric light and power installations,

should make application on or before Monday, 2nd September, 1957, to G. R. Barnsley, F.R.I.B.A., County Architect, Shire Hall, Warwick.

Applicants must forward particulars of contracts recently executed by them, giving the names and addresses of local authorities or persons to whom reference can be made. Tenders will be considered only from firms included in the official list which will be compiled by the appropriate committee after consideration of applications.

Contractors whose names are already included on the Council's approved list need not make application.

L. EDGAR STEPHENS,
Clerk of the Council.

Shire Hall,
Warwick.
July, 1957. 6896

COUNTY OF CORNWALL

NOTICE is hereby given of the intention to let separately the Sub-Contracts for Metal Windows and Electrical Services in connection with the erection of a NEW COUNTY SECONDARY SCHOOL for 450 pupils at HELSTON and a NEW JUNIOR SCHOOL for 200 pupils at ST. COLUMB MINOR, NEWQUAY, and also for Structural Steelwork for the former.

Applications are invited for permission to tender for any or all these Sub-Contracts and should be made to the County Architect, County Hall, Truro, not later than Saturday, 10th August, 1957, from which a selected number of firms will be invited to tender. The closing date for receipt of tenders will be notified when the documents are despatched.

The lowest or any tender will not necessarily be accepted nor will the County Council pay the contractors any fees or expenses incurred in the preparation of tenders.

E. T. VERGER,
Clerk of the County Council.

County Hall,
Truro.
26th July, 1957. 6923

COSELEY URBAN DISTRICT COUNCIL

Electric Street Lighting

TENDERS are invited for the erection of 105 Group B Electric Street Lighting Points in Sodium and Mercury Vapour on concrete columns.

Tender documents, returnable by first post on Monday, 19th August, 1957, may be obtained from the undersigned on deposit of £2 2s., which will be refunded on receipt of bona fide tenders not subsequently withdrawn.

The Council do not bind themselves to accept the lowest or any tender.

J. C. ROPER,
Clerk of the Council.

Council House,
Coseley,
17th July, 1957. 6911

BOROUGH OF SOLIHULL

Street Lighting, Stratford Road, Shirley

TENDERS are invited for the provision and installation on trunk road A.34 (Stratford Road, Shirley) of 21 Street Lighting Units, including 25-ft. steel columns, 140-watt sodium lamps, lanterns and auxiliary gear.

Specification, bills of quantities, forms of tender, etc., may be obtained from, and drawings and general conditions of contract inspected at, the office of the Borough Engineer, 90, Station Road, Solihull, on deposit of a fee of two guineas, returnable on receipt of a bona fide tender not subsequently withdrawn.

Tenders, sealed in the official envelopes provided, must be returned to the undersigned not later than noon on Friday, 23rd August.

The Council do not undertake to accept the lowest or any tender.

W. MAURICE MELL,
Town Clerk.

Council House,
Solihull.
25th July, 1957. 6947

BOROUGH OF MORLEY

Street Lighting, Trunk Road A.58

TENDERS are invited for the supply, erection and installation of 30 totally enclosed, non-cut-off type, 140-watt Sodium Lanterns mounted on 25-ft. concrete columns.

Specifications and forms of tender, upon payment of a deposit of £2 2s., which will be refunded after the receipt of bona fide tenders, will be supplied by the Public Lighting Engineer, Town Hall, Morley, to whom completed tenders should be returned not later than Monday, 19th August, 1957.

E. V. FINNIGAN,
Town Clerk.

Town Hall,
Morley, Yorks. 6873

SALFORD CITY TRANSPORT

TENDERS are invited for the rewiring of the Electric Lighting and Power Installations at the Weaste Depot, Eccles New Road, Salford, 5.

Specifications and forms of tender may be obtained on application to the General Manager and Engineer, Salford City Transport, Frederick Road, Salford, 6, Lancs.

Completed tenders must be returned to the Town Clerk, Town Hall, Salford, 5, Lancs, to be received not later than 9.30 a.m. on 10th September, 1957.

R. RIBBLESDALE THORNTON,
Town Clerk.
6924

FIFE COUNTY COUNCIL

Street Lighting, Hill of Beath

TENDERS are invited for the supply and erection of 21 Steel Columns, Brackets, Sodium Lanterns and ancillary gear for Group "A" Standard Street Lighting.

Tender documents, obtainable from the County Surveyor, Belfield, Cupar, must be returned, marked "Street Lighting, Kelty," by noon on Saturday, 31st August, to the County Clerk, Cupar, Fife. 6895

CLASSIFIED ADVERTISEMENTS ARE PREPAID

SITUATIONS VACANT

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

Worcester and District Sub-Area

DISTRICT ENGINEER (Evesham District). Applicants should have had a sound training and extensive experience in the construction, operation and maintenance of high voltage and low voltage distribution networks, and associated switchgear, transformers and protective systems. Technical qualifications desirable. Salary £1,160/£1,235 per annum (N.J.B. Grade F.3).

Apply by letter, within fourteen days, stating age, qualifications, experience, present position and salary, to Mr. R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

South Staffs and North Worcs Sub-Area

GENERAL ASSISTANT ENGINEERS (Commercial Department) (Headquarters). Applicants should have had experience in the installation of electrical equipment and of preparatory work connected therewith. The successful applicants will be required to assist in all branches of the department, particularly in the planning and installation of space heating equipment for all purposes. Technical qualifications desirable. Salary £685/£730 per annum (N.J.B. Grade L.16).

GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER (West Bromwich District). Applicants should have had practical experience in the sale and installation of domestic and commercial electrical equipment and the work associated therewith. The successful applicant will be required to assist in all branches of commercial work, including advising consumers on domestic, commercial and industrial equipment, estimating and contracting work. Technical qualifications desirable. Salary £685/£730 per annum (N.J.B. Grade F.11).

Apply by letter, within fourteen days, stating age, qualifications, experience, present position and salary, to Mr. T. G. Keeler, Sub-Area Manager (Ref. CW), Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton, Staffs.

Central Gloucestershire Sub-Area

SENIOR DEMONSTRATOR (Headquarters). Candidates should hold a recognised Diploma in Domestic Science and the E.A.W. Certificate for Demonstrators. Experience in service centre duties, demonstrations of all types of domestic appliances, and a knowledge of industrial and commercial catering equipment is essential. Candidates should also be capable of giving lectures in domestic science to women's organisations and of maintaining contacts with education authorities. Salary per annum (£660/£720 (N.J.C. Grade 3).

Apply by letter, within fourteen days, stating age, qualifications, education and experience, to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126, London Road, Gloucester.

A. STEPHENS,
Secretary.
6936

Situations Vacant (continued)

SOUTH EASTERN ELECTRICITY BOARD

PURCHASING AND STORES ASSISTANT, Croydon and West Kent Sub-Area. Salary N.J.C. Grade 5, £810 × £25 to £885, plus London weighting. Superannuable. Applicants must have experience of purchasing and stores and stock control on large scale. Knowledge of distribution and commercial stock and sound organising ability essential. Applications naming two referees, to T. A. D. Honnor, M.I.E.E., Croydon and West Kent Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 14th August, 1957.

SECOND ASSISTANT ENGINEER (Operation and Maintenance), Surrey Sub-Area Headquarters, Dorking. Salary £1,160-£1,235 p.a., under N.J.B. Class K, Grade 7. Superannuable. Applicants, preferably Corporate Members of the I.E.E., should have extensive responsible experience of the operation of urban and rural networks up to 33 kV with particular reference to system protection. The appointed person will be responsible to the senior assistant engineer primarily for the commissioning and maintenance of 33 kV plant and the operation and maintenance of all system protection throughout the sub-area. Applications naming two referees, from C. W. Hughes, B.Sc., M.I.E.E., Surrey Manager, SEEBOARD, Rough Rew, Ridgeway Road, Dorking, Surrey by 14th August, 1957.

DISTRICT ENGINEER, Dorking and Epsom District. Salary £1,160-£1,235, N.J.B. Class F, Grade 3. Superannuable. The successful candidate, preferably a Corporate Member of the I.E.E., will be responsible for the planning, construction and operation of a mixed urban and rural network supplying 36,000 consumers with a maximum demand of 39 MW. Experience on systems up to 33 kV will be an advantage and particular emphasis will be given to ability to organise work and control staff. Applications, naming two referees, on forms from C. L. B. White, District Manager, SEEBOARD, 56, South Street, Dorking, by 14th August, 1957.

GENERAL ASSISTANT ENGINEER, Medway District. Salary £635 × £15 to £680 p.a. under N.J.B. Class F, Grade 12. Superannuable. Applicants should hold the Higher National Certificate for Electrical Engineering or equivalent, and had training and experience in underground and overhead distribution. The position will eventually entail standby duties. Applications naming two referees, to Ramsden Mellor, Esq., M.I.E.E., Medway District Manager, SEEBOARD, Gardiner Street, Gillingham, Kent, by 14th August, 1957.

A. L. BURNELL,
Secretary.
6927

GOVERNMENT OF BAHRAIN

State Medical Department

A MECHANICAL/ELECTRICAL ENGINEER required in November to take charge of the installation, maintenance and operation of all electrical and mechanical services for a large new hospital in a rapidly expanding department.

Preference will be given to candidates between 26/40 years of age holding at least an Ordinary National Certificate in Electrical/Mechanical Engineering, having held a similar appointment for at least five years.

Consolidated commencing salary up to £110 per month, according to qualifications and experience, plus increments of £45 per year. There is also a pension fund.

Free bachelor quarters, with hard furnishings only, and medical attention provided. Married accommodation provided after satisfactory completion of 6 months' probationary period. Contract in the first place for a period of two years, subject to 6 months' probation. Lease is granted every two years at the rate of ten weeks per annum. Free passages by air to and from London, U.K., are provided for the applicant and his wife every two years.

Applications giving full details of qualifications, training and experience to be addressed to the Personnel Officer, Ewbank & Partners Ltd., 10/11, Grosvenor Place, London, S.W.1.
6886

CITY OF SALISBURY, SOUTHERN RHODESIA

Electricity Undertaking

Vacancies for Instrument Mechanics

APPLICATIONS are invited from suitably qualified persons for the following vacancies:—

(a) TEST ROOM INSTRUMENT MECHANICS.

Applicants must be capable of carrying out the repair, testing and calibration of all types of three phase and single phase meters, kVA and re-active kVA meters, high tension and low tension metering equipments with current transformers, and special bulk supply metering equipments. Experience in general test room work and the testing and calibration of indicating instruments and relays will be considered an advantage.

(b) POWER STATION INSTRUMENT MECHANICS.

Applicants must have had extensive experience in the calibration, repair and maintenance of instruments and control gear as used for steam power plant.

Wages are £21 12s. for a 48-hour week. No cost-of-living or other allowances are payable, and overtime is at prescribed rates.

The successful candidates must comply with the requirements of the Immigration Authorities and will be required to submit to the Council a satisfactory medical certificate of fitness.

Forms of application and further particulars regarding conditions of employment allowances towards travelling and removal expenses, etc., are obtainable from Davis & Soper Ltd., 52/54, St. Mary Axe, London, E.C.3, to whom applications should be submitted. 6847

THE BRUSH ELECTRICAL ENGINEERING CO. LTD.

has a number of interesting vacancies in both technical and commercial departments of its General Engineering Division for the following staff:—

SENIOR ELECTRICAL ENGINEER

SENIOR MECHANICAL DRAUGHTSMAN

ELECTRICAL SECTION LEADER DRAUGHTSMAN

ELECTRICAL DRAUGHTSMAN

TENDERING AND CONTRACT ENGINEER FOR COMPLETE STEAM POWER STATIONS

TENDERING ENGINEER FOR INDUSTRIAL ELECTRIFICATION SCHEMES

The Division is responsible for the design and layout of complete steam power stations, factory electrification projects and the application of electrical energy in industry.

Whilst previous experience in these fields is not essential, it is desirable, and overseas experience would be an added qualification for the first post above. Applicants for this post should also be chartered engineers, and for posts two and three should hold a Higher National Certificate whilst an Ordinary National Certificate is desirable for post four.

Applicants for the last two commercial appointments, should preferably have commercial experience although training can be given if necessary. Overseas experience would be an advantage, as would be an academic qualification.

Good salaries will be paid, and conditions of service include a generous non-contributory superannuation scheme.

Please apply to the Chief Personnel Officer, Brush Electrical Engineering Co. Ltd., Loughborough, Leics.

6937

CENTRAL ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

ASSISTANT SHIFT CHARGE ENGINEER, CASTLE DONINGTON POWER STATION (Vacancy No. 132/57/ER).

Applications are required from suitably qualified engineers who have had sound experience in the operation of modern high-pressure generating plant.

The salary will be in accordance with Class L, Grade 9 (£1,065-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 22nd August, 1957.

SENIOR DRAUGHTSMAN, TRANSMISSION DRAWING OFFICE, DIVISIONAL H.Q. (Vacancy No. 136/57/ER).

Duties would include work on electrical layouts and diagrams in the transmission drawing office. Experience on H.V. electrical equipment preferred but not essential.

Salary will be in accordance with Grade 5 £760-£860 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 29th August, 1957.

FOURTH ASSISTANT ENGINEER, BOURNE TRANSMISSION SECTION OFFICE (Vacancy No. 137/57/ER).

Applicants should have experience in the maintenance and operation of 132-kV overhead lines, transformers and substations.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 5 (£810-£1,035 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 29th August, 1957.

These appointments will be pensionable within the provisions of the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.
25th July, 1957. 6915

CENTRAL ELECTRICITY AUTHORITY

South Western Division

Technical Staff Vacancies

(a) SHIFT CHARGE ENGINEER, Feeder Road Power Station.

N.J.B. E.7, £835 - £880 (plus 10% shift allowance).

Applicants should have had considerable experience in power station operation. Graduate or corporate membership of a recognised engineering institution or equivalent desirable.

(b) THIRD ASSISTANT ENGINEER (Mechanical), Generation Construction Department.

N.J.B. Class AX/CX, Grade 4, £895-£1,020/£1,080.

Applicants should have good mechanical engineering training with experience in power station equipment, preferably including design work and preparation of specifications. Higher National Certificate or equivalent desirable.

Applications on form A.E.6/ACT, obtainable from your place of employment or the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 14th August, 1957. 6933

BRITISH KLOCKNER SWITCHGEAR LIMITED
Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear ; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area Headquarters, Bedford

ENGINEERING DRAUGHTSMAN (90/57.R).

Candidates should have had a good general and technical education and should preferably be experienced in substation design, layout of equipment, and the preparation of plans and detailed drawings of buildings and civil engineering works.

Salary N.J.B. Schedule D, Grade 6 (£595-£715).

Apply by letter within 14 days to S. F. C. Whitmore, A.M.I.E.E., Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend Street, Bedford.

Fens Sub-Area

GENERAL ASSISTANT ENGINEER (Operation and Maintenance) (91/57.N).

This position is in the Southern System based on St. Neot's for duty primarily in the Huntingdon area.

Candidates should have had a sound technical training. Some experience in the operation and maintenance of H.V. and L.V. distribution systems would be an advantage.

Salary N.J.B. Class J, Grade 15 (£635-£680).

Apply by letter within 14 days to the Secretarial Officer, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge.

Northmet Sub-Area, St. Albans District

SENIOR SALES REPRESENTATIVE (92/57.R).

Candidates must be of good address and have had sound practical training with experience in electrical installation work for domestic and commercial premises. A good knowledge of electric water heating and ability to prepare wiring specifications and estimates is essential.

Salary N.J.C. Grade 2 (£600-£660).

Apply by letter within 10 days to F. J. Drake, Assoc.I.E.E., District Manager, Eastern Electricity Board, 107, St. Peter's Street, St. Albans, Herts. 6935

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the following appointments, all subject to the N.J.B. agreement for the electricity supply industry.

(i) FOURTH ASSISTANT ENGINEER, Construction Section, Sub-Area Headquarters, Sunderland. Applicants should possess H.N.C. in Electrical Engineering or equivalent qualification and have had experience in preliminary work and construction of H.V. and L.V. overhead lines. Knowledge of underground cable and substation work an advantage.

Salary Schedule A, Class L, Grade 12, £885/£930.

(ii) FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, South Shields. Applicants should preferably be Graduate or Corporate Members of the I.E.E., or possess equivalent qualification in electrical engineering and have experience in the utilisation of electrical energy in commercial and domestic premises, knowledge of installation work and be conversant with tariffs, sales and all aspects of consumers' service.

Salary Schedule A, Class E, Grade 5, £935/£995.

(iii) FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, Consett (Stanley). Applicants should preferably be Graduate or Corporate Members of the I.E.E. or possess equivalent qualification in electrical engineering and have experience in the utilisation of electrical energy in commercial and domestic premises, knowledge of installation work and be conversant with tariffs, sales and all aspects of consumers' service.

Salary Schedule A, Class E, Grade 5, £935/£995.

Applications stating age, qualifications and experience, to be received by the Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 6926

SOUTH OF SCOTLAND ELECTRICITY BOARD

Stirling Area

APPLICATIONS are invited for appointment as (1) SECOND ASSISTANT ENGINEER in the Stirling District of the Area at a salary within the scale £835/£880 per annum (N.J.B. E.7) and (2) ASSISTANT ENGINEER in the Falkirk District of this Area at a salary within the scale £685/£730 (N.J.B. F.11).

Both posts are superannuated and conditions of service will be regulated by the National Joint Board Agreement. The successful candidates will be required to reside within reasonable distance of the place of appointment.

Experience in electrical distribution work is essential and it is also desirable that applicants should have technical qualifications of at least Higher National Certificate standard.

Applications are to be submitted on forms which can be obtained from the undersigned, not later than 31st August, 1957.

JAMES G. CURTIS,
Area Manager,
Woodlands,
St. Ninians Road,
Stirling.
24th July, 1957. 6929

JOHNSON & PHILLIPS LTD.

require for their

SWITCHGEAR DEPARTMENT

ENGINEERS. Accustomed to dealing with contracts and projects for L.T. and H.T. switchgear up to 11 kV. Applicants must be capable of working on their own initiative and handling generation and distribution schemes.

DRAUGHTSMEN. Should have experience of contract and layout applicable to all types of H.T. and L.T. switchgear up to 11 kV.

CIRCUIT ENGINEERS. Applicants must have experience of preparing protective and control schemes for generation and distribution switchgear.

The company offers first-class conditions of service, superannuation scheme, facilities for canteen, sport, social activities, etc.

Interviews can be arranged for any time, including evenings and Saturdays.

Write, giving details of age, training and experience, to :—

Employment Manager,
JOHNSON & PHILLIPS LTD.
Victoria Way, Charlton,
London, S.E.7

6815

ARCHITECTURAL AND BUILDING DRAUGHTSMEN

APPLICATIONS are invited from draughtsmen who have had experience in the preparation of working and detail drawings of ancillary buildings to power stations to join a section engaged in this work at Westminster.

Ample opportunities to gain knowledge of and for advancement in this important national work, with visits to site before and during construction.

Superannuation scheme and good working conditions with canteen facilities on the premises. Salary ranges from £635 to £910 p.a.

Apply by letter to Divisional Secretary, Central Electricity Authority, London Division, Generation House, Great Portland Street, London, W.1, or by telephone (MUSeum 6844, extension 240) for application forms. 6899

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

THIRD ASSISTANT ENGINEERS (Meters, Testing and Protection).

Candidates should have a wide experience in all branches of protective gear work, including network calculations. Some experience in general site electrical testing and cable fault location is desirable. Possession of technical qualifications to degree or Higher National Certificate standard are essential.

Salary N.J.B. Class M., Grade 10, £1,065/£25/£1,140 per annum.

GENERAL ASSISTANT ENGINEER (Meters, Testing and Protection).

Applicants should have had a sound training in electrical engineering and also hold the Higher National Certificate in Electrical Engineering.

Salary N.J.B. Class M, Grade 16, £740/£15/£785 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 16th August, 1957.

No. 7 (Grimsby) Sub-Area

GRIMSBY DISTRICT
SENIOR SERVICE CENTRE ASSISTANT.

Applicants should have experience in service centre work, including the sale of electrical appliances, hire purchase agreements, handling of enquiries, and must be capable of advising consumers on any matter relating to the use of electricity in their homes. Some experience of window display will be an advantage.

Salary N.J.C. Grade 2, £600/£20/£660 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby. 6925

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

South Caledonia Area

APPLICATIONS are invited for the undernoted vacancies in the Distribution Dept. at the Area Office in Perth.

1. FIRST ASSISTANT ENGINEER (Distribution Contracts and Stores).
   Applicants must have experience of the preparation of tender documents and the issue of contract instructions for overhead lines, underground cables and substations. A knowledge of buying and stores procedure is also desirable. Commencing salary N.J.B. G.5, at present £1,065-£1,140 per annum.
2. GENERAL ASSISTANT ENGINEER (Distribution Contracts).
   Applicants should have qualifications at least equivalent to Higher National Certificate. Commencing salary N.J.B. G.14, at present £590-£635 per annum.
3. ENGINEERING DRAUGHTSMAN.
   Applicants must have a sound drawing office training. Previous experience in the preparation of substation layout drawings and the design of overhead line structures is desirable but not essential. Commencing salary N.J.B. Schedule D, Grade 6, at present £595-£715 per annum.

In all cases the conditions of employment will be those laid down by the National Joint Board for the Electricity Supply Industry. The positions are superannuable.

Application forms, which can be obtained from the Board's Offices, must be completed and returned to the Area Manager, North of Scotland Hydro-Electric Board, South Caledonia Area, Blackfriars, Perth, within fourteen days of the date of this advertisement. 6912

THE GENERAL ELECTRIC COMPANY LTD.

HOUSECRAFT ADVISER / COOKERY DEMONSTRATOR with first-class experience and training is required for the South Coast. Preference will be given to applicants with E.A.W. Certificate and experience of demonstrating electrical equipment.

Applications in writing within ten days should give full details of age and record and be sent to the Branch Manager, Magnet House, Commercial Road, Southampton. 6903

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) an advantage.

CHEMICAL ASSISTANT,
BANKSIDE POWER STATION
(Vacancy No. 57/692).

Candidates should have G.C.E. at advanced level and an interest in investigational work in laboratory and on power station plant. Salary range £315 (age 18) to £580 (age 22) p.a., with variations on attaining degree and completing National Service.

CHEMICAL ASSISTANT,
BARKING A/B POWER STATION
(Vacancy No. 57/693).

Details as Vacancy 57/692.

(a) ASSISTANT ENGINEER (Electrical),
BARKING A/B POWER STATION
(Vacancy No. 57/694).

Applicants should have had previous experience of electrical maintenance and qualifications up to H.N.C. standard. Drawing office experience would be an advantage. Salary Class L, Grade 14 = £830 p.a.

(a) ENGINEERING DRAUGHTSMAN,
WEST HAM POWER STATION
(Vacancy No. 57/695).

General power station drawing office duty. Salary Schedule D, Grade 6 = £635/£755 per annum.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, C.E.A., London Division, P.O. Box 136, Generation House, Great Portland Street, London, W.1, and be received within 10 days of this advertisement. 6898

SOUTH OF SCOTLAND ELECTRICITY BOARD

Stirling Area

REPEAT ADVERTISEMENT

APPLICATIONS are invited from engineers with experience in the commercial side of electricity supply work, including contracting, for appointment as FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER in the Stirling District of the Area.

Technical qualifications of at least Higher National Certificate standard are required.

The post is superannuated and the salary will be within the scale of £885/£930 (N.J.B. E.6).

The successful candidate will be required to reside in the District and within reasonable distance of the place of appointment.

Applications are to be submitted on forms, which can be obtained from the undersigned, not later than 31st August, 1957.

JAMES G. CURTIS,
Area Manager.

Woodlands,
St. Ninians Road,
Stirling.
24th July, 1957. 6928

THERMONUCLEAR ENGINEERING GROUP

at

A.E.R.E., HARWELL,

requires ELECTRICAL TECHNICIANS to assist, initially, in supervising and progressing the manufacture and erection of experimental equipment and, later, to join operating teams. The plant includes H.T. supplies, vacuum equipment, monitoring equipment, etc.

An apprenticeship or equivalent training is required, and experience in these fields and/or high-power radar, high-energy physics equipment, etc., is desirable. Also O.N.C. or similar qualifications.

£835 (at 30) to £1,000.

Housing, superannuation and other excellent conditions.

Send POSTCARD by 9th August, 1957, for further details and an application form to—

GROUP RECRUITMENT OFFICER
(858Y/48), A.E.R.E.,
HARWELL, DIDCOT, BERKS.

6876

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

GENERAL ASSISTANT ENGINEER is required at Walsall Power Station for generation operational duties. N.J.B. service conditions, superannuable appointment, salary within Schedule A, H14, £635-£680 per annum. An additional 10% of basic salary is payable when engaged on shift duties.

The appointment is permanent with excellent opportunities for advancement. It is necessary that applicants should have received a sound technical training and should preferably have had some industrial engineering experience and have as a minimum qualification the Ordinary National Certificate.

Apply, quoting vacancy number 608MD, on form AE6, available from the Establishments Officer, 53, Wake Green Rd., Moseley, Birmingham, 13, by 14th August, 1957. 6897

A PROFESSIONAL ENGINEERING APPOINTMENT

in the field of

ELECTRICAL POWER SYSTEMS STUDY.

THE ENGLISH ELECTRIC COMPANY, STAFFORD, is interested in appointing a qualified Electrical Engineer or Physicist to conduct theoretical investigations and analytical studies into problems concerning electrical power systems.

Prospects are good. Analytically minded candidates who realise electrical power engineering presents a rewarding challenge are invited to apply to Central Personnel Services, Marconi House, 336/7, Strand, London, W.C.2, quoting reference ER.1218R.

May we add that Stafford is a pleasant county town not the centre of a heavy industrial area.

6894

ENGLISH ELECTRIC

PROFESSIONAL engineering appointments are available with this Group on a range of Manufacturing, Design and Application engineering duties on all classes of electrical equipment. Experience in manufacturing, power generation and supply or in the utilisation of electricity is the qualification sought and professional engineers in any of these fields are invited to apply for consideration.

A number of vacancies also exist for trained engineers seeking an opportunity of acquiring further experience and scope in this class of work.

All appointments are pensionable after qualifying period.

Apply, stating age, experience and qualifications, to—

Dept. C.P.S.,
336/7, Strand, London, W.C.2,
quoting
Ref. ER418A.

6877

CITY OF SALISBURY, SOUTHERN RHODESIA

Vacancy for Power Station Chemist

APPLICATIONS are invited for the vacancy of CHEMIST GRADE 2 (salary scale £1,325 × £50 to £1,525 p.a.) on the fixed establishment staff of the Electricity Department.

Candidates must have had sound general and scientific education, and should hold a recognised degree in chemistry. The post requires experience in the analysis of fuels, oil and water, and familiarity with modern methods of water treatment and boiler water control is essential. Previous experience in the field of power engineering will be a recommendation.

The salary payable will commence at the minimum of the scale, and rise by annual increments. No cost-of-living or other allowances are payable.

Details of the general conditions of service, leave, pension and medical aid funds and travelling expenses may be obtained from the offices of the undersigned. The successful candidate will be required to submit a medical certificate of fitness to the Council's approval, and must also be able to comply with the requirements of the Immigration Authorities.

Applicants are required to submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be included.

Canvassing, directly or indirectly, will be a disqualification.

Applications, suitably endorsed on the envelope, should reach the offices of the undersigned on or before 23rd August, 1957. Air mail paper should be used.

DAVIS & SOPER LTD.

54, St. Mary Axe,
London, E.C.3. 6900

COUNTY BOROUGH OF DONCASTER EDUCATION COMMITTEE

Doncaster Technical College

Principal:
W. Lomax, M.Eng., B.Sc., A.M.I.Min.E.

ELECTRICAL ENGINEERING DEPT.

APPLICATIONS are invited for the appointment on the teaching staff of the above College of an ASSISTANT GRADE A or B, according to qualifications.

Applicants should possess a university degree or equivalent qualification and have suitable practical experience. The teaching required will be general Electrical Engineering and ancillary subjects up to Ordinary National Certificate standard and Electrical Technology for craft classes.

Salary will be in accordance with the Burnham (Technical) Scales. Commencing salary will be dependent on industrial and teaching experience.

Application forms may be obtained from the undersigned and should be completed and returned as soon as possible.

V. H. HOSKIN,
Chief Education Officer.

Education Offices,
Whitaker Street, Doncaster. 6887

SALES MANAGER (ELECTRICAL ENGINEER)

INSTRUMENT Division of well-known Group seeks SALES MANAGER. Applicants should preferably be graduates and/or have served a full student apprenticeship in electrical engineering. They must have some familiarity with control systems and complicated circuitry, preferably based on experience in instruments, control gear or telecommunications.

The post offers excellent prospects at the higher management level to a man with technical versatility and commercial acumen. Locality London. Contributory pension scheme, minimum salary £2,000 per annum.

Applicants should send full particulars to Messrs. Linklaters & Paines (J.H.F.), 59/67, Gresham Street, London, E.C.2, marking envelopes "Electrical Engineer," and be prepared to attend an interview board. The strictest confidence will be extended and expected.

6902

EAST MIDLANDS ELECTRICITY BOARD

Fourth Assistant Engineers, Northamptonshire Sub-Area

APPLICATIONS are invited for appointments as FOURTH ASSISTANT ENGINEERS at the Northamptonshire Sub-Area Headquarters.

Candidates should preferably possess a qualification equivalent to the Higher National Certificate in Electrical Engineering and have had experience in some of the following :—

Design construction, operation and maintenance of L.V. and H.V. underground and overhead systems up to and including 33 kV. Protection and communication equipment, preferably including V.H.F. radio.

The salary and conditions of the appointments will be in accordance with the National Joint Board Agreement, Class K, Grade 13 (£790 × £15 to £835 per annum).

Applications should be addressed to the Manager, Northamptonshire Sub-Area, 25, Bridge Street, Northampton, to reach him within fourteen days of the date of this advertisement. 6901

ARTHUR GUINNESS SON & CO. (DUBLIN) LTD.

St. James's Gate Brewery, Dublin

have a vacancy for an

ELECTRICAL DRAUGHTSMAN.

An excellent opportunity for an enterprising man between 23 and 28 years of age, possessing Higher National Certificate or Part 2 of I.E.E. Examination or equivalent, with experience in lighting, power and electronic layouts in process industry.

The post is a progressive one with a commencing salary in the range £596 to £800 commensurate with qualifications and experience. Promotion to higher grades possible.

Non-contributory pension scheme.

Assistance in moving home.

Please write to the Chief Engineer, giving chronological particulars of education, technical training, apprenticeship and posts held.

For those selected for interview, all travelling expenses will be paid. Successful candidate must pass a medical examination of high standard. 6665

PHYSICISTS AND ELECTRONIC ENGINEERS

required by CENTRAL ELECTRICITY AUTHORITY to work in the Electronics and Instruments Section of the Research Laboratories at Leatherhead, Surrey, on problems of vibration, acoustic noise or radio interference.

Candidates should have a degree or equivalent qualification, and the ability to apply fundamental knowledge to a wide variety of problems.

The work on vibration and noise involves a study of the fundamental problems, development and use of measuring techniques in the generating and transforming stations of the C.E.A., and an assessment of the results. The work on radio and television interference from high-voltage transmission lines involves field strength and voltage measurements at radio frequencies, calibration of equipment and analysis of experimental data.

Salaries within scale £820-£995 p.a.

Applications stating age, qualifications, present position and salary, and giving full details of experience, should be forwarded to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 17th August, 1957. Quote ref. ER/327. 6874

POWER STATION INSTRUMENT ENGINEER

required by

KUWAIT OIL COMPANY

for service in KUWAIT

APPLICANTS, not under 30 years of age, must have had at least 5 years' experience in a modern power station on instrument repair and maintenance. Must have a good knowledge and understanding of automatic boiler control. Preferably with some operating experience. Total pay including local allowance not less than £1,715 p.a. Pension scheme.

Write for application form giving brief details and quoting K.2303, to Box T/90, c/o 191, Gresham House, London, E.C.2. 6932

HUDDERSFIELD CORPORATION PASSENGER TRANSPORT DEPARTMENT

Appointment of Technical Assistant (Engineering)

APPLICATIONS are invited for the above position on the permanent staff. Salary A.P.T. Grade II (£610-£692 per annum).

Applicants should have a Higher National Certificate in Electrical Engineering and also drawing office experience.

Duties will include technical development on both electrical and mechanical equipment fitted on motor buses and trolley buses, and also supervisory control of traction substations. Appointment is superannuable and subject to medical examination.

Full particulars, including age, experience and names of two referees, to reach the undersigned not later than Saturday, 24th August, 1957.

H. MUSCROFT,
General Manager.

John William Street,
Huddersfield. 6916

AUTOMATIC TEMPERATURE CONTROL

DESIGN & PROJECT ENGINEERS wanted for Technical Department of leading manufacturer of automatic temperature controls used for central heating, air conditioning, etc.

Design Engineers must have had experience in original design of small electro-mechanical devices either directly or indirectly associated with temperature control.

Project Engineers must have had experience in conversion of prototypes into production designs using latest production techniques.

Good salaries and pension schemes. Apply in writing stating training, experience and salary required to the Technical Superintendent, The Rheostatic Company Limited, Farnham Road, Slough, Bucks. 6704

THE GENERAL ELECTRIC COMPANY LIMITED,

Witton, Birmingham, 6,

requires a

QUALIFIED DRAUGHTSMAN

for work on electronic gear in the Rectifier Works.

Please apply with full particulars to

THE STAFF MANAGER. 6930

CENTRAL ELECTRICITY AUTHORITY

South Eastern Division

ASSISTANT CONTROL ENGINEER to undertake switching and load despatching shift duties in Thames South Grid Control Area Control Room.

Applicants should preferably have practical experience in the operation and control of an inter-connected power system and/or in the operation of power station plant. Sound technical training required. Graduate membership of recognised engineering institution or comparable qualification an advantage.

N.J.B. conditions of service. Salary Class AX/EX, Grade 4, £984 10s. to £1,254 per annum, including 10% shift enhancement.

Applications giving details of education, present position, experience, etc., should be sent to the Establishments Officer, Central Electricity House, Lower Ham Road, Kingston-on-Thames, Surrey, so as to arrive by 17th August, 1957, quoting reference (207). 6934

FORD MOTOR COMPANY LIMITED

have a vacancy for an Electrical Engineer (A.M.I.E.E. or H.N.C.) to act as

PERSONAL ASSISTANT

to the

SENIOR ELECTRICAL ENGINEER

for the design and installation of electrical services. Applicants should have had a sound technical training and be well experienced in E.H.T. and L.T. substations, ring main cables, general distribution schemes, lighting, telephones, machine and plant wiring. They should also be capable of preparing specifications and estimates, supervising staff, and negotiating with consultants and contractors.

Salary according to experience and ability, with participation in a generous non-contributory pension scheme.

Please write to Salaried Personnel Department, Ford Motor Company Limited, Dagenham, Essex, stating age, experience and qualifications, and quoting reference EET. 6913

CENTRAL ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following post :—

ASSISTANT SHIFT CHARGE ENGINEER, LITTLE BARFORD GENERATING STATION.

Salary Class G, Grade 9, £835 × £15 to £880 per annum plus 10% shift allowance.

Applicants should have served an apprenticeship and obtained an Ordinary National Certificate in Electrical and/or Mechanical Engineering, or equivalent. Preference will be given to applicants who have had experience in the operation of generating station utilising pulverised fuel.

Applications stating age, qualifications and experience should be sent to the Controller, Central Electricity Authority, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by 10th August, 1957.

W. N. C. CLINCH,
Controller. 6914

THE GENERAL ELECTRIC COMPANY LIMITED,

Witton, Birmingham, 6,

requires a

QUALIFIED DRAUGHTSMAN

for work on fractional horsepower motors of all types. Experience in light engineering acceptable.

Please write with full particulars to

THE STAFF MANAGER. 6931

LEVER BROTHERS, PORT SUNLIGHT, LIMITED

invite applications from

ELECTRICAL DRAUGHTSMEN

for work of considerable interest. The company carries out its own design work on a wide variety of industrial applications of electricity, and also in connection with large-scale utility services to Unilever factories on Merseyside, including Port Sunlight, involving the operation of large industrial boiler plants and generating stations.

Applicants should possess a minimum qualification of an Ordinary National Certificate in Electrical Engineering.

The conditions of employment are attractive in terms of salary, amenities and a five-day working week. Superannuation scheme.

Applications giving brief details of qualifications and experience should be made in writing to the Personnel Manager, Lever Brothers, Port Sunlight, Limited, Port Sunlight, Cheshire. 6917

CLASSIFIED ADVERTISEMENTS ARE PREPAID

Situations Vacant (continued)

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

A FOURTH ASSISTANT ENGINEER is required in the Telecommunications Section of the Technical Department. N.J.B. service conditions, superannuable appointment, salary within Schedule B, Grade 6, commencing in range £710 to £835, ultimately rising to £935 per annum.

Preference will be given to candidates who have had experience with telecommunications equipment, and the possession of a qualification equivalent to the Higher National Certificate in Electrical Engineering would be an advantage.

Apply, quoting Vacancy No. 602MD, on form AE6, available from the Establishments Officer, 53, Wake Green Rd., Moseley, Birmingham, 13, by 15th August, 1957. 6807

SQUARE D LIMITED
100, Aldersgate Street
London, E.C.1

ELECTRICAL ENGINEER, B.Sc., or equivalent. Age 30-40, with experience in design and application of electric motor control desired.

To serve as assistant and understudy to present temporary American Chief Engineer.

Write to General Manager giving details of education, experience and salary requirements.

Applications will be treated as confidential.

9041

NEWMAN INDUSTRIES LIMITED

in connection with their expansion programme in the manufacture of electric motors require a

DEPARTMENTAL MANAGER

to control one of their decentralised production units.

The work would comprise the supervision of production control, process planning, material control, work study and labour.

Only applicants who are engineers with experience of organising production will be considered.

Age preferred, 30-38 years.

Applications to :—

The Managing Director,
NEWMAN INDUSTRIES LIMITED,
Yate, Bristol

6828

THE GENERAL ELECTRIC COMPANY LIMITED

have vacancies for

OPERATING ENGINEERS

for the Operational Service Department of the Turbine Division at Erith, Kent.

The duties involve dealing with a wide range of operating problems on turbo-alternators from 400 kW to 120,000 kW capacity and on blowers up to 100,000 c.f.m.

Minimum qualifications are H.N.C. and a sound experience of power station operation.

Apply giving age and details of experience to Personnel Manager (O.E.), The General Electric Company Limited, Fraser & Chalmers Engineering Works, Erith, Kent.

6832

SALES ENGINEERS

LAURENCE, SCOTT & ELECTROMOTORS Limited require SALES ENGINEERS for their Manchester Office.

Applicants should have received training with a manufacturer of rotating electrical machinery. They should be between 25 and 35 years of age and hold the Higher National Certificate or equivalent in electrical engineering.

Write in confidence, stating age, qualifications and experience to :—

Sales Director,
LAURENCE, SCOTT & ELECTROMOTORS LTD.
Openshaw, Manchester, 11 6779

REACTOR DESIGN

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL,

requires ASSISTANT DESIGN ENGINEERS for work relating to the design, construction and operation of experimental nuclear reactors.

Experience in a drawing office on chemical plant, mechanical engineering and/or electro-mechanical design, and a recognised apprenticeship and H.N.C. (or equivalent).

Salary £795 - £1,210.

Housing, superannuation and other excellent conditions.

Send POSTCARD by 9th August, 1957, for further details and an application form to—

GROUP RECRUITMENT OFFICER
(865Y/48), A.E.R.E.,
HARWELL, DIDCOT, BERKS.

6875

SALES ENGINEER

YOUNG engineer required for outside technical sales staff in Midlands Area for sale of Power Factor Correction Capacitors.

Applicants should be keen, energetic and able to drive a car.

The successful applicant will receive brief training and have access to established contacts and every assistance from existing staff.

Reply:—

Sales Manager,
BRYCE ELECTRIC CONSTRUCTION CO. LTD.,
Kelvin Works, Hackbridge, Surrey.

6862

BRITISH KLOCKNER SWITCHGEAR LIMITED
Chertsey, Surrey

ESTIMATOR for TECHNICAL SALES. Correspondence and capable of preparing control schemes involving automatic motor control gear. Experience essential.

CIRCUIT DIAGRAM DRAUGHTSMAN. Preferably experienced in preparing automatic control gear schemes.

Applicants to have O.N.C. (Electrical). Excellent opportunities with fast growing concern. Pension scheme. Apply to Managing Director, stating experience and present salary.

165

PUBLICITY ASSISTANT

BRUCE PEEBLES & Co. Ltd., Engineers, Edinburgh, require a man with experience in technical journalism and ability to write lucid descriptions of electrical engineering products and processes for publicity, press, and other purposes. The successful applicant will be required to assist with the writing and editing of a works magazine and should preferably have a good electrical engineering qualification.

Replies, stating full details of education, training, experience, age, present post and salary, to J. S. Baillie, Publicity Manager, at the above address. 6860

YOUNG ENGINEERS

interested in gaining experience of the erection of lattice tower, concrete and wood pole overhead transmission lines and willing to serve either at home or overseas. Technical background up to H.N.C. (Electrical) standard desirable, but previous experience of this kind of work not essential. Pension fund.

Write giving full particulars and quoting reference C/76/55 to Staff Officer, British Insulated Callender's Construction Company Limited, 30, Leicester Square, London, W.C.2.

174

BARROW IRONWORKS LIMITED
Barrow-in-Furness

ASSISTANT ELECTRICAL ENGINEER required with sound technical training and practical experience on maintenance, installation, generation and control equipments up to 6,600 v. A.C. On heavy plant as associated with blast furnaces.

The post is superannuable.

Reply, giving full details of education, training, etc., to Managing Director, Barrow Ironworks Limited, Barrow-in-Furness. 6766

A LARGE and progressive London company manufacturing electronic telephone and telecommunication equipment has vacancies for technical engineers and assistants with suitable qualifications and previous experience. Work will cover circuit design and laboratory testing of new switching development projects, using both standard and electronic methods, or the preparation of equipment layouts and exchange and contract specifications. B.Sc., H.N.C., or final C. and G. in telecom., all desirable, but main emphasis on experience. Salaries in the range of £450-£900 for assistants and £700-£1,100 for seniors according to age and qualifications. Excellent conditions and prospects. Assistance with removal and housing difficulties if necessary. We are looking for men of ability and invite you to write in confidence with full details to—Box 6767.

A.C. control gear sales engineer for Newcastle and North-East England. H.N.C. or equivalent qualifications with previous experience in control gear desirable. Good starting salary with excellent prospects of advancement. Applications to Technical Director, Kloeckner-Moeller England Ltd., 28 Oxford St., Manchester 1. 6878

ADMINISTRATION manager, aged 30-40, required by long-established electrical contractors, N.W. London area.—Box 6918.

APPLICATIONS are invited from electrical engineers aged 28 to 35, holding at least H.N.C., for a position in design office of specialist medium-size company 30 miles south of London. Salary £1,000 p.a. offered for at least 7 or 8 years' experience in designing wide range of H.V. and L.V. transformers. New housing available. Superannuation scheme. Apply in strictest confidence, giving full details of scholastic qualifications and technical experience, to—Box 6816.

ASSISTANT electrical engineer required with knowledge of estimating for all types of contracts. Midland office. Full details with application to—Box 6834.

ASSISTANT engineer required by lighting equipment and transformer manufacturers in London. Ability to handle small staff. Good opportunities for advancement. Apply stating experience and salary required.—Box 9042.

ASSISTANT manager required for expanding transformer department. Must be capable of designing most types of transformers up to 250 kVA. Good prospects for the right man. Annual bonus scheme.—Austin Walters & Son Ltd., Ayres Road, Trafford, Manchester, 16. 6940

AUTOMATION. Contactor electric control gear engineer for training on automation and related schemes, including control of machine tools. H.N.C. or equivalent qualification preferred. Permanent position. Good starting salary with excellent prospects of progressive remuneration. Write in confidence, giving full details of previous experience, qualifications, age and salary expected, to—Technical Director, Donovan Electrical Co. Ltd., Stechford, Birmingham, 33. 6941

B.B.C. requires engineer for transmitter equipment section, planning and installation department, London. Engineering degree or equivalent qualification, practical training and experience, broad knowledge of technical aspects and application of a wide variety of electrical plant, including switchgear, transformers, rectifiers, A.C. and D.C. motors and generators, contactor and control gear, batteries, cables, etc., and ability to supervise layout and diagram work essential. Knowledge of products of leading manufacturers and diesel engine equipment an advantage. Applicants should be experienced in contract procedure, writing of specifications and examination of tenders for power plant and equipment. Duties include planning, specifying and supervising installation of switchgear and power equipment at high power transmitting stations, also supervision of junior staff. Starting salary £1,060 rising by five annual increments to £1,365 p.a. Permanent pensionable post. Application forms to Engineering Establishment Officer, Broadcasting House, London, W.1, quoting ref. E.123 E.R. 6943

CABLE jointer : Journeyman cable jointer required with experience of cable laying and installation in industrial premises and substation work. Successful applicant would be required to travel to outlying jobs. Apply in writing stating age and giving details of previous experience to—Box 6879.

CHIEF inspector required for Hemel Hempstead, Herts, area. Experienced in Ministry and A.I.D. contracts incorporating electrical and precision engineering. Salary £750 upwards, according to experience. Must be fully conversant with modern methods and able to take complete control.—Box 6904.

CONTRACTORS have an interesting vacancy in the Home Counties for a fully experienced plumber-jointer capable of handling 11-kV and L.V. work of all types with the minimum of supervision. Must be able to drive and prepared to travel. Write with full details of previous experience to the Staff Manager.—Box 6888.

CROMPTON PARKINSON Limited require a chief technical engineer at their Derby cable works. Applicants should be Corporate Members of the I.E.E. or equivalent and should possess an intimate knowledge of the design and manufacture of paper, rubber and thermoplastic insulated cables up to and including 33 kV. The position offers exceptional scope to the right man and provides excellent working conditions with superannuation fund facilities. Applicants should provide full details of past experience and qualifications, together with salary expected. Applicants should be addressed to the Director and General Manager, Derby Cables Ltd., Alfreton Road, Derby. 6818

DRAUGHTSMAN or trainee for industrial contactor electric control gear for automation and related schemes, including control of machine tools. O.N.C. or equivalent qualification preferred. Permanent position. Good starting salary with excellent prospects of progressive remuneration. Write in confidence, giving full details of previous experience, qualifications, age and salary expected, to—Technical Director, Donovan Electrical Co. Ltd., Stechford, Birmingham, 33. 6942

DRAUGHTSMAN required by well-known firm of electrical manufacturers for interesting work on special applications for entire new range of products. Electrical engineering and O.N.C. (elec.) essential. Vacancy offers considerable prospects for man of personality, tact and initiative, capable of handling direct technical negotiations with customers. Full details of training, experience and qualifications to the Sales Director.—Box 6919.

DRAUGHTSMEN required in electrical drawing office of large steel works. Electrical experience desirable but not essential. Position gives valuable opportunity to applicants having varying degrees of experience. Apply—Labour Manager, Samuel Fox & Company Ltd., Stocksbridge Works, Nr. Sheffield. 6781

ELECTRIC lamp manufacturers require experienced all-round foreman capable of running modern automatic lamp-making unit and conversant with flame setting and mounting mill adjustment, etc. Good salary to the right man, excellent prospects and pension. Write—Ascot Lamps & Lighting Ltd., Arcola Street, London, E.8. 6864

ELECTRICAL contractors, Eastern Counties, require supervising engineer to handle wiring contracts from estimating to final billing. Fine opportunity with big prospects leading to directorship for energetic young man (22-40) with sound practical and technical knowledge, able to interview and advise clients and also seek out business. Reply in confidence stating experience, age and commencing salary.—Box 9063.

ELECTRICAL contractors, North-West Kent area, require services of a part-time or free-lance estimator, experienced in general lighting, power and heating systems. All enquiries treated with strict confidence.—Box 9061.

ELECTRICAL draughtsmen required by major oil company in the Middle East. Applicants, who should not be over 45, should preferably hold an H.N.C. or at least an O.N.C., and have at least 4 years' experience in an electrical engineering drawing office on work relating to installation and distribution schemes, power station layout, flameproof equipment, domestic and industrial lighting layouts. Two-year tours of duty followed by paid home leave. Salary £2,100 per annum net. Air passages paid. Write giving age, qualifications and brief career details to—Box ER.305, c/o 191 Gresham House, London, E.C.2. 6920

ELECTRICAL estimator required for electrical contracting department of engineering company. Good salary and excellent prospects for further promotion. Canteen and pension scheme. Apply in writing to—Moxey Ltd., 13, Augustus Road, Birmingham, 15. 6905

ELECTRICAL engineer required in London area for the design of electrical installations in all types of buildings. Must be capable of running a project through all its phases, including site supervision. Write giving full details of qualifications, experience and salary required to — Box E.R.200, L.P.E., Romano House, 399-401, Strand, London, W.C.2. 6948

ELECTRICAL sales engineer, aged 23 to 30, required in export department (London) of well-known manufacturers of electric motor starting and control gear. Position offers scope, good salary, prospects, and is pensionable. Write stating age, present salary and experience. —Box 6880.

ELECTRICIANS and electrical fitters required by Bowaters United Kingdom Pulp and Paper Mills Limited, at their Kemsley Division. Written applications to be addressed to Personnel Officer, Bowaters United Kingdom Pulp and Paper Mills Limited, Kemsley Division, Sittingbourne, Kent, stating (1) age; (2) experience; (3) particulars of apprenticeship served. Applicants must be prepared to work overtime, including Sunday (alternative rest day arranged). Good conditions and rates of pay. Canteen facilities. Contributory pension scheme. Non-contributory sick benefit scheme. 6906

INSPECTING engineer (electrical) required by consulting engineers to operate in the South of England from their Weybridge office. Applicants should preferably be between 25 and 35 years of age and should have had experience in the inspection and testing of electrical equipment with a bias towards control, instrumentation, protection and electronics. They must also possess graduate or prospective I.E.E. membership. Salary and prospects will be commensurate with the character of the appointment. Application forms should be applied for in writing to "Staff Appointments," Kennedy & Donkin, 813a, Wilmslow Road, Didsbury, Manchester, 20. 6796

INSTRUMENT testers required for test room with experience in wiring, calibration and testing of electrical measuring instruments. These are staff appointments. Apply in writing to—Everett, Edgcumbe & Co. Ltd., Colindale Works, Hendon, London, N.W.9. 6881

LARGE public company requires for new large subsidiary factory first-class works technician for the manufacture of universal motors suitable for portable tools and similar appliances. Must combine best works and technical design experience, able to evolve new motor types and be up-to-date with the latest modern mass production and factory management methods. Suitable candidate offered highly attractive contract, together with housing assistance and other long-term benefits. Present staff advised. Write fully in confidence to Technical Director.—Box 6907.

MEN capable of earning a four-figure income by commission added to a basic salary of £750 per annum, plus approved travelling expenses, are invited to apply to our Managing Director for a private interview. London experience and expert knowledge of electrical wholesaling is essential. — E. Dawson (Lamp Factors) Ltd., 10, Grays Inn Road, London, W.C.1. 6944

OPPORTUNITY for keen man (about 30) to take charge of sales office of old-established London firm in lighting industry. Experience in lighting fittings sales activities desirable but not essential. Applicants must have good knowledge of the electrical trade and be accustomed to dealing with users, contractors, architects, etc. Good prospects for keen organiser. 5-day week; pension fund. Write fully, stating age, experience and salary range.—Box 6690.

SALES representative (age 25/30 years) with electrical engineering background required by old-established electrical engineering company in North-West London, to train as sales representative. Superannuation scheme. Write giving full details of age, experience and salary required to—Box 3MD.2783, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. 6708

SALESMAN required by well-known electrical accessory manufacturer to cover London and Eastern territories. Must have good connections with the Electricity Boards, wholesalers and contracting trades. Good opportunity for right man. Age 30-35. Apply giving full particulars of experience, etc. All replies will be treated in strict confidence. Our staff know of this announcement.—Box 6908.

PHILIPS ELECTRICAL Ltd. invite applications from electrical mechanics of O.N.C. standard education or equivalent experience for posts as service engineers. Duties, after training, will cover installation and maintenance of industrial X-ray and scientific equipment in any part of U.K. Applicants should be between 20/35 years of age, with a keen desire to extend their knowledge of high-voltage engineering and electronics, and the ability to work on own initiative. A current driving licence is an advantage. Please reply detailing experience and qualifications to—Personnel Officer, Century House, Shaftesbury Avenue, London, W.C.2, quoting ref. 121. 6889

SAO PAULO LIGHT S.A.- SERVICOS DE ELETRICIDADE, a company in Brazil and a subsidiary of the Canadian corporation, Brazilian Traction, Light & Power Company Limited, invite applications from suitably qualified men for the position of shift charge engineer in the Piratininga Power Station. The power station was completed about three years ago and is situated near Sao Paulo (pop. 2.5 millions; temperate climate; 2,200 ft. above sea level). The plant comprised initially 2 × 80-MW, 1,800-r.p.m. steam turbo-alternator units, each supplied at 850 p.s.i., 900° F., by one 850,000-lb./hr. oil-fired boiler, and is now being expanded by the addition of two 125,000-kW reheat units, 1,800 p.s.i., 1,000° F. Applicants should have a sound technical knowledge and wide experience of the operation of modern turbines and boilers, preferably with oil or pulverised-fuel firing; should also have an aptitude for supervision and the maintenance of harmonious labour relations. Good salary, three years' agreement subject to renewal with first class passage both ways; four months' paid leave after three years' service. Written application in the first instance should be made to Mr. W. P. Kellett, Joint Manager, Canadian-Brazilian Services Ltd., 148, Leadenhall Street, London, E.C.3. 6820

SENIOR electrical engineer required for interesting and varied work. A.M.I.E.E. and/or graduate, with experience in modern power distribution, rotating and static equipment, electronics, instrumentation, design of automatic controls, modern heating techniques, etc. Age 30 to 40 with knowledge and experience of modern labour control and administration. Salary commensurate with qualifications and experience. Apply in writing to Personnel Manager, Ferodo Limited, Chapel-en-le-Frith, Via Stockport. 6882

SIEMENS EDISON SWAN Ltd., Woolwich works, London, S.E.18. Experienced electrical engineers required to join in the work of a rapidly expanding division on the design, development and engineering of a new range of electronic and allied equipments. Knowledge of one or more of the following essential: electronic and telecommunication switching, audio engineering, remote control, indication projects, process control. Scope for original thinkers to apply new ideas, backed by full resources of large modern factories. Starting salaries from £800-£1,000 for senior men with adequate experience. H.N.C. or equivalent desirable, but all applicants will be assessed in the light of their experience. Men of the right calibre, seeking further experience, responsibility and hard work, should write with full details to the Staff Officer, Ref. 744/82, address as above. Any housing or removal queries can be helpfully discussed. 287

SOUTH WALES SWITCHGEAR Ltd., Blackwood, Mon., require a design draughtsman for circuit breaker development and associated work. Application giving full particulars of education, experience and salary required to the Personnel Manager. 6797

STOREKEEPER for switchgear and conduit fittings, preferably able to drive. Good wages and excellent prospects for keen man. Write or phone—Leslie Maynard Ltd., 306a, Fulham Road, London, S.W.10 (Flaxman 3526). 158

STOREKEEPER required, must be fully conversant with conduit, conduit fittings and all types of wiring accessories. Permanent position. Pensions scheme. Reply—Manager, Walsall Conduits Ltd., 239, North End Road, W. Kensington, London, W.14. 6891

TECHNICAL assistant required by expanding electrical manufacturers in Redditch to assist with estimates and contracts. Higher National Certificate or Graduate I.E.E. preferred but not essential. Excellent prospects and pension scheme. Write stating age, qualifications, experience and salary required to—Box 6890.

Situations Vacant (continued)

TECHNICAL assistant (electrical) for interesting experimental work on control gear for small to medium-sized motors, battery charging equipment, etc. O.N.C. in electrical subjects is desirable, plus some industrial experience. Modern factory. Good working conditions, canteen. Attractive salary to right man. Apply in writing to J. Dewar, Personnel Officer, Lansing Bagnall Ltd., Kingsclere Road, Basingstoke, Hants. 6938

TELEPHONE order clerk required, thoroughly conversant with conduit fittings, switchgear and all wiring accessories. Permanent position. Pensions scheme. Reply — Manager, Walsall Conduits Ltd., 239, North End Road, W. Kensington, London, W.14. 6892

TRANSFORMER designer (senior) required. Applicant must have wide experience in design and manufacture of units up to 250 kVA. Promotion to directorship offered after qualifying period with commensurate salary and bonus. Housing accommodation if required. Replies will be treated in strict confidence.—Stewart Transformers Ltd., 75, Kilburn Lane, London, W.10. 6866

TWO stores assistants required by progressive London wholesaler. Good knowledge of trade desirable. Good prospects; non-contributory pension scheme. Apply in writing to—The National Electrical Supplies Co. Ltd., 240/244, King Street, Hammersmith, London, W.6. 6835

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

A.M.I.E.E., 38, seeks progressive position London/Southern Counties. Experienced design H.V. and L.V. installations, progress, procurement, inspection heavy power equipment. Present salary £1,250.—Box 9051.

B.ENG.(Hons.), A.M.I.E.E., A.M.I.Mech.E. (40), returning U.K. from govt. posting end July, 4½ yrs. consulting engineers, 9 yrs.' manufacturing experience switchgear engineers, seeks executive or resident engineer's post.—Box 9044.

CABLE jointer seeks position in London or Nth. Kent area. Experienced up to 33 kV, also used to live work.—Box 9057.

DESIGN and development engineer, B.Sc., A.M.I.E.E. (35), seeks responsible position Central, South or East London.—Box 9046.

ELECTRICAL engineer, just returned from 4 years overseas, experienced contracting, estimating, installations, overhead lines, underground cables, motor repairs, requires supervisory position home or overseas.—Box 9048.

ELECTRONICS industrial engineer experienced in all branches of radio, television and electronic manufacture, including semi-automatic coil winding, printed circuits, assembly mass-production layouts and American quality control methods, also with a flair for design simplification, seeks change of post for personal reasons. Willing to go abroad.—Box 9060.

ENGINEER (31) seeks position offering advancement as reward for diligence. Graduate I.E.E., H.N.C., Mechanical, with experience of marine, medium engineering and textile plant installations.—Box 9043.

FOREMAN/supervisor (37), experience overseas contracting large building installations, H.V./L.V. distribution, desires further overseas employment.—Box 9062.

WINDING shop. Foreman/manager (40), experienced all types windings, assembling motors, coils, transformers, A.C./D.C. production or repair shop, desires progressive position.—Box 9049.

ARTICLES FOR SALE

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 6373) 191

DIESEL ALTERNATOR SETS

400/440 volts, 3-phase, 50 cycles

500-kVA PETTER "SS" vertical 6-cyl. water cooled Engine. Comp. air start. BRUSH Alternator. Auxiliaries, control gear, etc. 600 r.p.m.

250-kVA PETTER "SS" vertical 3-cyl. water cooled Engine. Comp. air start. BRUSH Alternator. Auxiliaries, control gear, etc. 600 r.p.m.

187-kVA WAUKESHA vertical 6-cyl. radiator cooled Engine. Eng. start. G.E.C. Alternator. Control gear. 1,000 r.p.m.

162.5-kVA CROSSLEY vertical 6-cyl. water cooled Engine. Comp. air start. L.D.C. Alternator, control gear. 500 r.p.m.

149-kVA RUSTON vertical 5-cyl. water cooled Engine. Comp. air start. L.D.C. Alternator, control gear. 600 r.p.m.

100-kVA MIRRLEES vertical 3-cyl. water cooled Engine. Comp. air start. G.E.C. Alternator, control gear. 600 r.p.m.

93.5-kVA BLACKSTONE vertical 3-cyl. water cooled Engine. Comp. air start. E.C.C. Alternator, control gear. 600 r.p.m.

68.8-kVA CROSSLEY vertical 6-cyl. water cooled engine. Elec. start. BRUCE PEEBLES Alternator, control gear. 1,000 r.p.m.

62.5-kVA McLAREN vertical 5-cyl. radiator cooled engine. Elec. start. BRUCE PEEBLES Alternator, control gear. 1,000 r.p.m.

62.5-kVA PERKINS vertical 6-cyl. radiator cooled Engine. Elec. start. METRO-VICK Alternator, control gear. 1,500 r.p.m.

58-kVA FOWLER vertical 6-cyl. radiator cooled engine. Elec. start. L.D.C. Alternator, control gear. 1,500 r.p.m.

37-kVA PERKINS vertical 6-cyl. radiator cooled Engine. Elec. start. HIGGS Alternator, control gear. 1,500 r.p.m.

27-kVA CROSSLEY vertical 3-cyl. radiator cooled engine. Hand start. CROM-PARK. Alternator, control gear. 1,000 r.p.m.

20-kVA LISTER vertical 3-cyl. radiator cooled Engine. Hand start. CROM-PARK. Alternator, control gear. 1,000 r.p.m.

14-kVA NATIONAL vertical 2-cyl. radiator cooled Engine. Hand start. B.T.H. Alternator, control gear. 1,000 r.p.m.

THOS. W. WARD LTD.
Albion Works, Sheffield
(Phone 26311, ext. 347; Grams, Forward).
322

LARGE 3-PHASE MOTORS FOR PROMPT DELIVERY

H.P.	Type.	Make.	Voltage.	Speed r.p.m.
650	S.R.	C. PARK.	3.3 kV	223
550	S.R.	C. PARK.	3 kV	223
550	S.R. T/E.	GANZ	550 v.	1450
340	S.C. T/E.	HARLAND	3.3 kV	1475
250	S.R. T/E.	G.E.C.	2.2 kV	750
215	S.R.	C. PARK.	440 v.	589

GEORGE COHEN SONS & CO. LTD.
Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 6883

CRABTREE I.C. SWITCH AND FUSEGEAR

WE have purchased the remaining stocks of this make and can offer immediate delivery of most types from 10 to 100 amps., D.P., T.P. and S.P. & N.; also

CRABTREE WOOD-CASED DISTRIBUTION BOARDS

and spare fuse bridges for most of the range.

Very Attractive Discounts.

Apply for complete lists of types available:

THE ELECTRICAL EQUIPMENT CO.
4, Carburton Street, London, W.1
(Tel. MUSeum 3966) 6603

D.C. GENERATORS

UNUSED 30-kW, 225-v. D.C. Generators, MAWDSLEY, compound wound; 133 amps., 1,100 r.p.m.; Admiralty Class II; cowl ventilated with regulators.

First-class condition; fully tested. Immediate delivery.

GEORGE COHEN SONS & CO. LTD.
Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 6884

CITY OF LEEDS

OFFERS are invited for the purchase of surplus secondhand Electric Street Lighting Lanterns, comprising:—

140 B.T.H. Urban Enclosed Top and Side Entry (Group A).
14 B.T.H. Mazdalux Side Entry (Group A).
60 Revo Top Entry Enclosed (Group A).
40 G.E.C. do. do. (Group A).
256 Revo Magnalites (Group A).
(Various types, some unused.)

These items may be inspected at, and full details may be obtained from, the Street Lighting Department, Springwell Street, Leeds, 12. Offers should be sent to the Town Clerk, Room 57, Civic Hall, Leeds, 1, not later than 16th August, 1957.

L. A. DOXEY,
Street Lighting Engineer.
6893

PLANT FOR SALE

SIX ELLISON Combined Starter Units comprising Star/Delta Starter, 60 h.p., rated 400 volts, 100 amps., 3-phase, 50 cycles. Fitted 1 N.V. and 3 overload releases. Dust-tight cover over trip adjustment tubes.

Isolator. Triple-pole air-break, locks in "on" and "off" position. Ammeter mounted.

Necessary cable boxes attached, the whole suitable for wall or pillar mounting. In operation 6 months and in good condition.

AVAILABLE IMMEDIATELY.

Offers—

THE CEMENTATION CO. LTD.
Civil Engineering Dept. (Ref. KWF)
20, Albert Embankment, London, S.E.11
6799

SOUTH WALES SWITCHGEAR DISTRIBUTION EQUIPMENT

SWITCHBOARD, 440/3/50, comprising:—

1 1,500-amp. Circuit Breaker.
2 1,200-amp. Circuit Breakers.
1 800-amp. Circuit Breaker.
8 600-amp. Circuit Breakers.

Date 1941; horiz. isolation; each breaker has a shunt trip coil and separate panel carrying ammeter, earth fault and overcurrent relays. Condition as new.

GEORGE COHEN SONS & CO. LTD.
Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 6885

1,500-kW TURBO-ALTERNATOR SET FOR SALE

ONE 1,500-kW BELLISS-LANCASHIRE Steam Turbo-Alternator Set complete with Jet Condensing Plant.

Steam pressure 150 lb. per square inch with 100° F. superheat.

Alternator direct coupled 1,875 kVA, 1,500 kW at .8 power factor, 3,300 volts, 50 cycles at 3,000 r.p.m.

This set, which was installed in 1925, has been in regular service until recently and is in excellent working condition.

This plant is surplus to our requirements as it is being replaced by a larger set.

Box 6921.

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler: also Marine, Cornish vertical, etc.—Burford, Taylor & Co., Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- Slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/- Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALUMINIUM, brass and copper in sheets, rods, tubes, angles, etc. Sheared blanks a speciality. Approved stockholders. For immediate attention, phone or send your inquiries—R.D.C., 100, Hamstead Rd., London. N.W.1 (EUSton 5176/7). 352

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, second-hand and new up to 30 h.p. Starters, slide rails and pulleys. Ring. Mon. 3355 for your requirements. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

BRUCE Peebles 250-h.p. synchronous motor, 400 volts, 3-phase, 50 cycles, 1,500 r.p.m., complete with George Ellison starter.—Whitefield Machinery & Plant Limited, Cobden St., Salford, 6 (Tel. PEN. 4746). 303

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (Ealing 3155/6). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, 110 and 220 v. D.C./230 v. A.C., .5 to 6 kVA; also A.C./D.C. Special voltages at short notice.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FANS, desk and ceiling type, D.C., all voltages and sizes in stock. — Universal Electrical, 221, City Road, London, E.C.1. 6837

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues.—The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FRACTIONAL h.p. motors, new, ex stock, A.C./D.C., Universal, B.T.H., Delco-Remy, G.E.C., Fracmo, Newman, Scophony. — Jeary Electrical Co. Ltd., 5, Lamb's Buildings, London, E.C.1. 126

GENERATING plants, remote and M/F up to 10 kVA; also secondhand A.C. and D.C. sets up to 100 kVA, large stock all types. Special plants built at short notice.—Powerco Ltd., 312, York Rd., London, S.W.18 (Tel. VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam, from 1 kW up to 700 kW. A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 161

HOUSE service meters, C. & H., Aron, E.A.C., 20-240 v. A.C., s.-ph., 50 c., 2½ amps., 7s. 6d. each, 1s. 6d. postage; 5 amps., 17s. 6d.—Universal Electrical, 217-221, City Road, London, E.C.1. 37

LANCASHIRE motor generator sets. One 500 kW, output 400/200 volts D.C., 3-wire, 985 r.p.m. One 100 kW, similar, 1,470 r.p.m. Motors at present 400 volts, single-phase, 50 cycles, can be re-designed for 400 volts, 3-phase, 50 cycles. Static balancers and Brookhirst switchgear available. Ball and roller bearings throughout. Flexible couplings. Further details and photographs from Dynamo & Motor Repairs Ltd., North End Road, Wembley Park (Tel. Wembley 3121). 6711

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS, starters, circuit breakers. Large stock of all types, ¼ to 300 h.p., new or reconditioned, for immediate delivery. Stock list or quot'n by return.—J. S. Ramsbottom & Co. Ltd., Elec. Engs., Keighley (3774/5/6). 70

NAMEPLATES, engraving, diesinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

OFFERS invited, one 70-kW electrode boiler, by Bastian & Allen, complete with all switchgear, pumps, etc. Perfect condition. Engineer's report, can be seen working. Apply —Cave, Jacksonhill Farm, Queensbury, Near Bradford. 9056

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. or D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk. London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switch-holder incorporated is proving itself the most popular unit. Suitable for most fittings. 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

QUARTERLY Credit Meters, single & poly-phase, 2½-100 amps. From 17/6d. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes: enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 34

SMALL BA screws and nuts in steel, brass and stainless steel, from stock.—Premier Screws & Repetition Co. Ltd., Woodgate, Leicester. 180

SWITCHGEAR: Ironclad fused switches, 400 60-amp. 12s. 6d. ea., 800 15-amp., 5s. ea., 200 40-amp. 7s. 6d. ea.; 300 0-300 voltmeters, 7s. 6d. ea.; 300 0-100 ammeters, 7s. 6d. ea.; 100 15-amp., 6-way distribution boards, 15s. each. In lots of 25. — Mideastra Ltd., Cardiff Road, Reading (Tel. 50458). 6922

TELEVISION slotmeters & Time Switches. Details from: Tradex Meter Co., Surbiton. Elmbridge 4487. 172

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generator sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

10-h.p. motor, 415/3/50, 750 r.p.m., fitted with automatic centrifugal clutch and pulley for 7 V-belts. Price £55, cost £115. Little used.—Phone Hoddesdon 3853. 9058

1,000 new storage cells for sale, heavy duty, 570 amps., ebonite container and sealed covers. Orig. made for Admiralty, packed 4 per wood case for transit. Low price for quantities.—Burleigh Alpine Works, Empire Way, Wembley (Tel. 0211). 324

EQUIPMENT FOR HIRE

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW diesel or petrol, stationary or mobile, sale or hire. 24-hr. breakdown service.—Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

RELIABLE, self-contained diesel electric generating sets for hire, 2.5 to 260 kW. Night and day maintenance service. Quotations by return.—Whitetrade Limited, Rochester, Kent (Tel. Chatham 4638/9). 294

ARTICLES WANTED

DIESEL GENERATING SETS

of about 100 h.p. wanted.

Full details to

Box 6945.

BRADLEY Redundant Electricals, 74, Eversleigh Rd., London, E.6 (Phone GRA. 2750). London leading clearing house for all redundant electrical stock and equipment, A.C. and D.C. motors, generating plants, welders and diesel sets. Complete factories bought and dismantled if required, also small or large stocks of scrap cable (dismantled if required). Estimates given. 185

HARRINGTON & SONS, reclamation contractors, want redundant A.C./D.C. electric motors and transformers, stocks of cable, etc. — 109, Beaconsfield Street, New Beckton, East Ham, London, E.6 (ALB. 1388). 315

READY money for redundant electrical equipment. Complete works bought outright for expert and rapid dismantling.—F. C. Larkinson Ltd. (Est. 1880), Hitchin Street, Biggleswade, Beds. (Tel. 2391) (12 branches throughout the country). 281

SURPLUS laminations, enamel copper wire, screws, nuts, flex. Good prices paid. Full details to—Box 199.

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

150-h.p., 970-r.p.m. slipring motor, 400 v., 3-phase, 50 cycles, with starting gear. L.D.C. or C.P. with Ellison gear preferred. Also two 5-h.p., 960-r.p.m., 230-volt D.C., totally enclosed, fan-cooled or dustproof motors. Details to—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 6712

WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 92

PRODUCTION sheet metal capacity available by company with stove enamelling and electrical assembly facilities, i.e., fluorescent fittings, electric fires, etc.—Box 6576.

SMALL armature, stator, transformer and general coil winding undertaken on production run.—Kensal Electrics Ltd., 151, Kensal Rd., London, W.10 (LAD. 4530). 202

TRANSFERS and display cards made to customers' requirements at competitive prices. — Ashfield Screen Printing Ltd., Borrowash, Derby. 9045

AGENCIES

AGENTS wanted to sell to wholesalers, contractors and factories imported voltage-testing equipment. Territories available include Lancashire, Yorkshire, Bristol, S. Wales and N. Ireland. Please reply to—Box 6946.

EXCLUSIVE agency Midlands area. Commission representative required by manufacturers of automatic electrical control equipment.—Box 6774.

BUSINESS OPPORTUNITIES

ELECTRICAL contractors, North East Coast, established nearly 40 years, expanding into the field of plant and speciality equipment distribution, would like to make contact with manufacturers interested in establishing sole distribution, installation and maintenance arrangements in the four Northern Counties and the North Riding of Yorkshire.—Box 6454.

ELECTRICAL engineer (A.M.I.E.E.) moving to Southern Rhodesia would welcome enquiries from manufacturers interested in representation in Salisbury. Any likely suggestions considered.—Box 9040.

MANUFACTURERS of quality fluorescent fittings, tubes, starters and control gear wish to contact quantity buyers, wholesalers, agents, etc., interested in purchasing in quantity at special low prices. Advertisers are interested in long or short term arrangements.—Box 213.

SMALL wholesale firm covering East Anglia wishes to contact small manufacturers of any quality product saleable to electrical retailers or contractors.—Box 9059.

BUSINESS PREMISES

BOROUGH OF SWINDON

Letting of Shop, Marlowe Avenue, Walcot, Swindon

THE Corporation have available for letting a single-fronted shop in the group of six new shops at Marlowe Avenue in the Walcot neighbourhood. Offers are invited on the basis of a five-year tenancy from persons or firms who are interested in trading in Electrical Goods, Wireless and Cycles, etc.

Application forms, full details of the shop and accommodation, and terms on which the tenancy will be granted, can be obtained from the undersigned.

The closing date for applications is the 16th August, 1957.

The Corporation do not bind themselves to accept the highest or any offer.

D. MURRAY JOHN,
Town Clerk.

Civic Offices,
Swindon.
26th July, 1957. 6939

DRURY Lane, London, W.C.2. Small storeroom available, 18 × 20 ft.—HOLborn 8622. 6909

EDUCATIONAL

CITY & Guilds (Electrical, etc.) on "No Pass —No Fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook. Free and post free.—B.I.E.T. (Dept. 12A), 29, Wright's Lane, London, W.8. 100

LEARN electrical engineering the practical way. Our new self-study course includes equipment on which experimental work can be carried out. Also courses for all professional examinations. Free brochure from E.M.I Institutes, Dept. ER57, London, W.4 (Associated with H.M.V.). 318

WORK study. Part-time (evening) 20-week diploma course starts 9th Sept. Enrolments open now. Details of this and 5 other courses, including full-time (6 weeks) and correspondence, from — School of Time & Motion Study, 29, Cork Street, London, W.1 (REGent 0516). 6786

MISCELLANEOUS

NOTICE

ATELIERS DE CONSTRUCTION ELECTRIQUES DE CHARLEROI

Manufacturers of Electrical Equipment known under the mark

A C Γ C
(Eh-Seĸ)

have removed their London Office to CROMWELL HOUSE, FULWOOD PLACE, HOLBORN, LONDON, W.C.1.

6910

COMPANY MEETINGS

THOMAS DE LA RUE & CO. LTD.

Year of Progress and Consolidation

Two Events of Major Importance

THE 60th Annual General Meeting of Thomas De La Rue and Company Limited was held on 24th July in London.

Mr. B. C. Westall, C.B.E., M.A. (the Chairman) presided and, in the course of his speech, said :—

The profit, before taxation, has risen from £911,645 to £1,181,878. This is the first time in the company's history that a profit has exceeded £1 million, and I think we might view this as a landmark in our business.

This year that has passed has been one of progress and consolidation. Our turnover has reached new records and we have made our record profit in spite of the fact that, in common with many other companies, we undertook price maintenance for the past year. The rise in costs has been met partly by greater efficiency in the factories and partly by expanding turnover. Also, two events of major importance have occurred. One is the placing of a contract for machines for the printing of the U.S. Currency by the United States Treasury, and the other is the conclusion of an agreement between the American Cyanamid Company and ourselves for the development of FORMICA laminates.

Apart from the value of the contract itself, it is, I think, the greatest compliment that could be paid to Thomas De La Rue & Co. Ltd. that the Bank of England and the United States Treasury should have selected the De La Rue machines for the printing of the Pound and the Dollar. After referring to other developments in the Security Division, the Chairman reviewed developments on the Plastic side of the business, and, commenting on the agreement with the American Cyanamid Company, said : We have agreed to form a new company called Formica Limited with a share capital of £3 million which will acquire most of the assets in our present Plactics Division. Your company will receive in exchange shares in Formica Limited of a par value of £2,800,000. American Cyanamid Company will assign permanently to Formica Limited, in exchange for shares of a par value of £200,000, the trade mark FORMICA with the goodwill attached to it in all parts of the world other than the Americas, Japan and the Philippines. American Cyanamid intend to purchase for cash at par sufficient shares to bring up their holding to the maximum of 40%. An important item in the agreement is the provision for a period of 25 years for full and complete exchange of technical information in the field of laminated plastics. We also attach considerable importance to the fact that our export markets, particularly in the Far Eastern area, have been greatly expanded, and both for American Cyanamid and ourselves the fact that we are marketing plastic products throughout the world under the common trade mark FORMICA on a permanent basis will give immense advantages over our competitors.

Other Activities

In the Potterton Division there has been some small improvement on previous results, and there is no doubt this would have been wholly satisfactory if the Suez crisis had not coincided with the launching of the full range of our new oil-fired boilers. In addition to this new undertaking of ours in oil burning we have produced a number of new gas-fired boilers which have had a very favourable reception by the gas industry and the public in general, and I believe that this side of our activities will show further improvement this year.

There has been no improvement in the results of the Stationers Division in spite of strenuous efforts to make headway after a prolonged period of disappointments. However, I hope to be able to report better news about this old section of the company's activities when we meet this time next year.

Next year I again hope to be able to record another year of progress and expansion. Continued progress will depend on whether free enterprise is going to be allowed to develop freely. We in De La Rues believe that success can only be achieved by boldness in launching new products, in the building of factories at home and abroad, and the untiring search for new markets.

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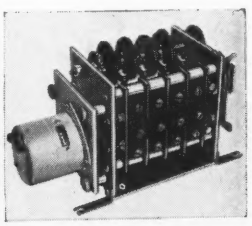

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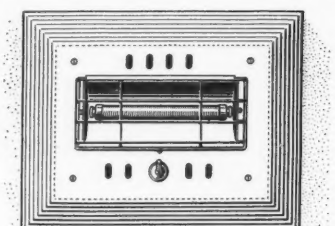

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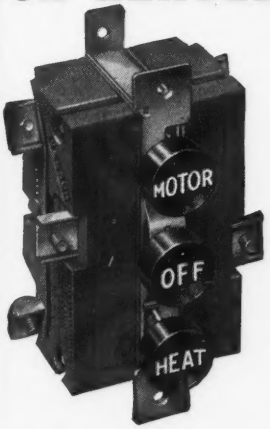

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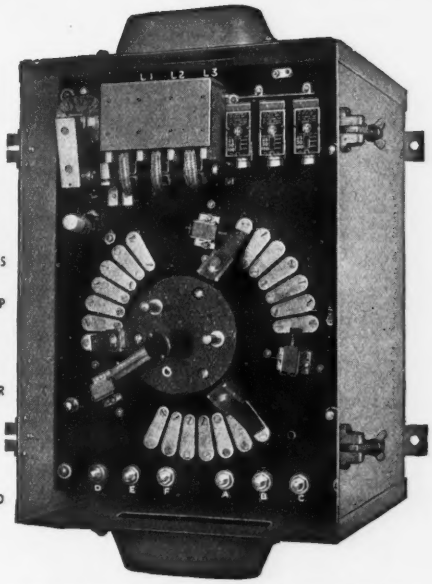

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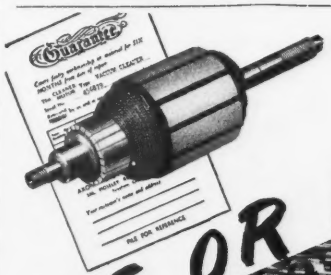

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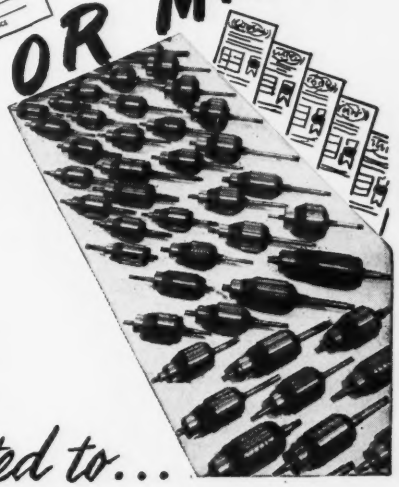

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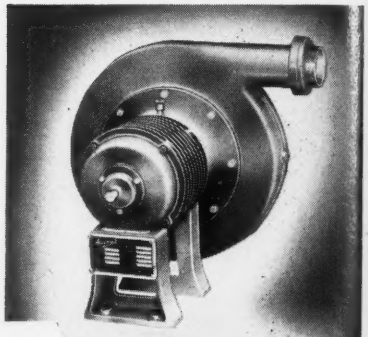

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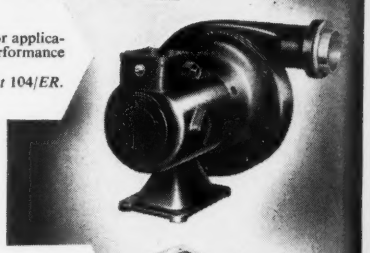

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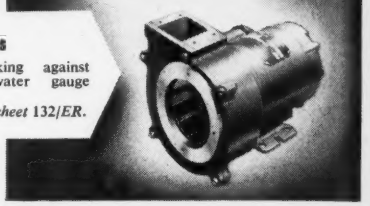

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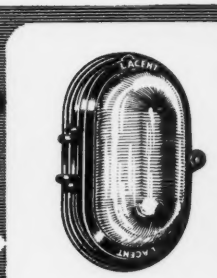

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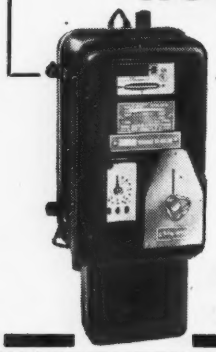

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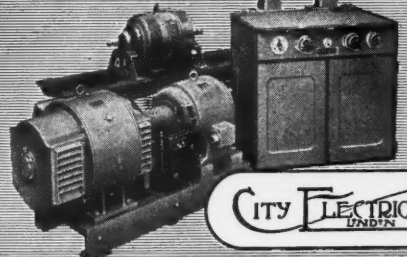

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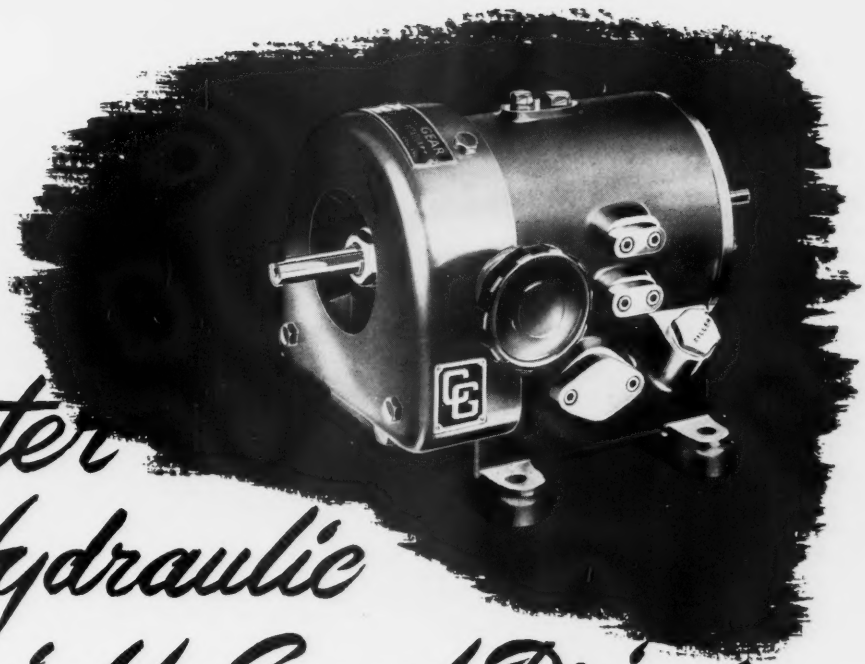

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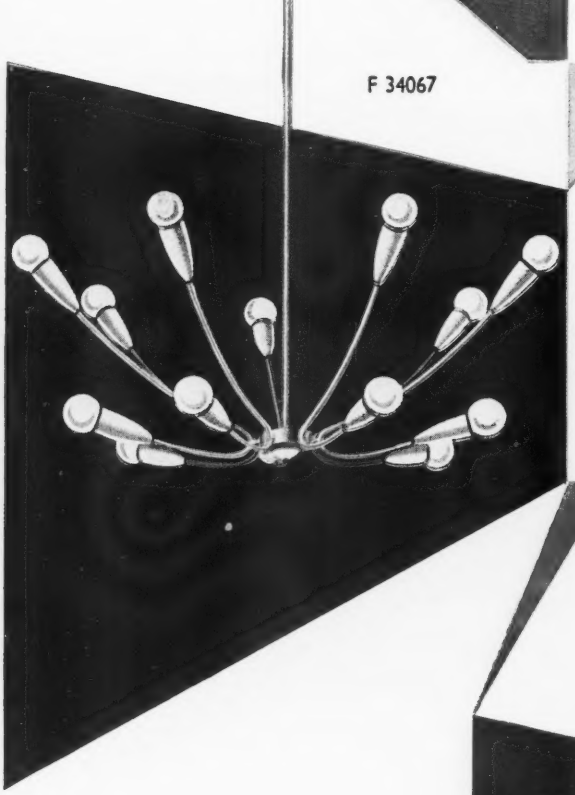

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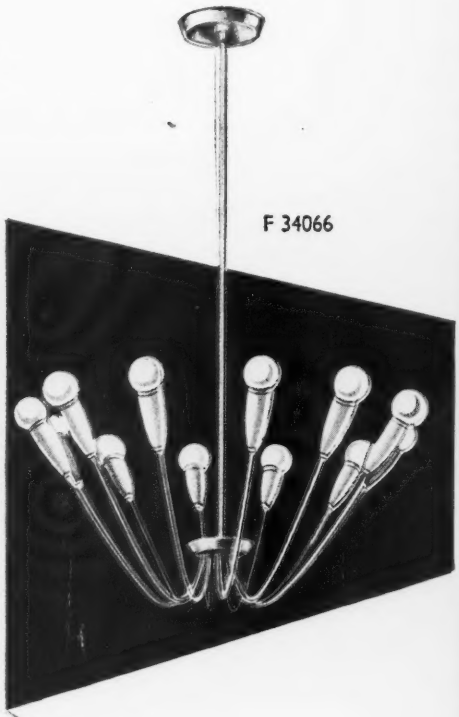

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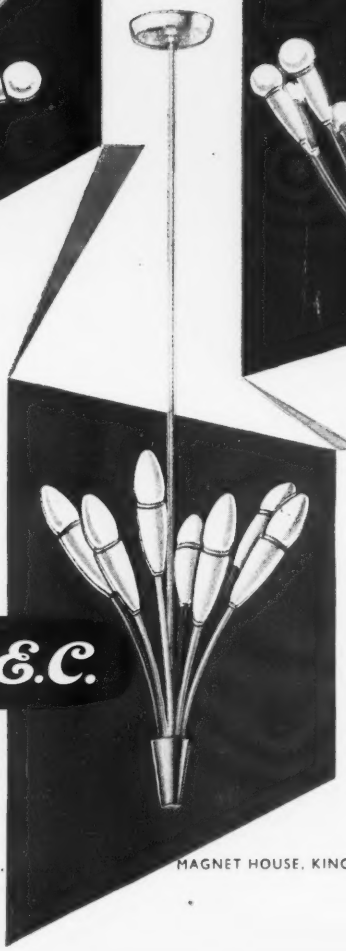

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